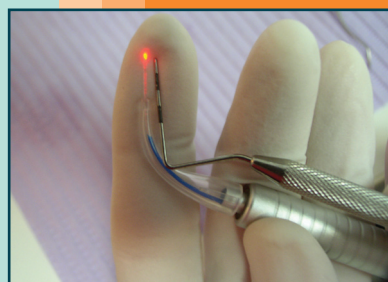


Soft-Tissue Lasers in Dental Hygiene

Jessica Blayden and
Angie Mott



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Angie Mott, RDH



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A John Wiley & Sons, Inc., Publication

<http://dentalebooks.com>

This edition first published 2013 © 2013 by John Wiley & Sons, Inc.

Wiley-Blackwell is an imprint of John Wiley & Sons, formed by the merger of Wiley's global Scientific, Technical and Medical business with Blackwell Publishing.

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Library of Congress Cataloging-in-Publication Data

Blayden, Jessica.

Soft-tissue lasers in dental hygiene / Jessica Blayden, Angie Mott.

p. cm.

Includes bibliographical references and index.

ISBN 978-0-470-95854-4 (pbk. : alk. paper)

1. Lasers in dentistry. I. Mott, Angie. II. Title.

RK685.L37B53 2013

617'.058-dc23

2012028348

A catalogue record for this book is available from the British Library.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic books.

Cover design by Modern Alchemy LLC

Set in 9.5/12pt Palatino by SPi Publisher Services, Pondicherry, India

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Acknowledgments

As both of us are moms and wives before we are dental hygienists and laser consultants, we want to thank our families for allowing us the numerous hours we spent on this book and put other things off. We realize that the time taken from all of you can never be replaced, but we hope you know how much all of you are loved and appreciated.

We would also like to thank all of our mentors who introduced and taught us about lasers.

Jessica Blayden and Angie Mott

DISCLAIMER

At the time of publication, the information provided in this book was accurate; however, in the world of laser dentistry technology advances daily.

Soft-Tissue Lasers in Dental Hygiene

1 Laser history

The use of lasers in dentistry today has evolved from its beginnings in 1960. In that year, Therodore H. Maiman (Figure 1.1) developed the first laser and called it *Maser* (Maiman 1960). Then he developed the first dental laser, the *Ruby laser*, which became the laser of choice for research and clinical applications. However, concerns soon arose whether the scattering of the Ruby's laser beam damaged adjacent teeth. By the end of the 1960s, most researchers conceded that it was the high level of energy excessively emitted that was the biggest cause of severe thermal damage to the tooth (Taylor 1965).

Soon after Maiman's Ruby laser, a Neodymium laser was produced by Snitzer and was known for its active medium, which helps it emit radiation. The Neodymium:yttrium-aluminum-garnet (ND:YAG) laser was produced, but it was not as popular as the Ruby laser. However, the use of the pulsed Ruby laser may have delayed the use and production lasers within dentistry as whole.

However in 1916, it was Albert Einstein (Figure 1.2) who postulated the theory of lasers (i.e., spontaneous and stimulated emission of radiation) in the *Zur Quantum Theorie Der Stralung* (Einstein 1916). He described it as a phenomenon wherein molecules, excited by a source of energy, ultimately create an organized pattern of energy that can be directed in a specific way (Goldman et al. 1964). Thus, based on this definition, LASER stands for light amplification stimulated emission of radiation. And it is an active medium that stimulates the radiation.

Active mediums are an element in the form of a mineral, gas, or liquid. For the laser to be stimulated, photons are produced according to Einstein's



Figure 1.1 Theodore H. Maiman. Image courtesy of Kathleen F. Maiman.

theory, which describes how radiation is stimulated or spontaneously emits itself. Photons are defined as an elemental quantity or quantum of radiant energy. The active medium allows each type of atom only to absorb photons of certain wavelengths, and each medium produces specific wavelengths for each individual laser, which seeks different target tissues. Light of differing wavelengths interacts distinctly based on its wavelength. In addition, each laser has different absorption qualities depending on where the laser is on the electromagnetic spectrum, from 300 nm to 10.6 microns (Miserendino et al. 1987). The two most common lasers used in dentistry for periodontics are the ND:YAG and diode lasers, and they will be discussed in great detail in this book.

To get a basic understanding of lasers, a brief discussion of their evolution is warranted. The first generation of lasers in dentistry were carbon dioxide (CO₂) lasers, which were big complicated machines (oral surgeons bought them), and they had no contact cut, meaning that whatever the laser was directed toward, it cut. This laser created a significant char layer and was thought to be a biological advantage in healing. But further research revealed that charring is not a biological bandage in the healing process.

The second generation of dental lasers was the ND:YAG laser. The ND:YAG laser is a crystal laser with a gentler cut and less charring.

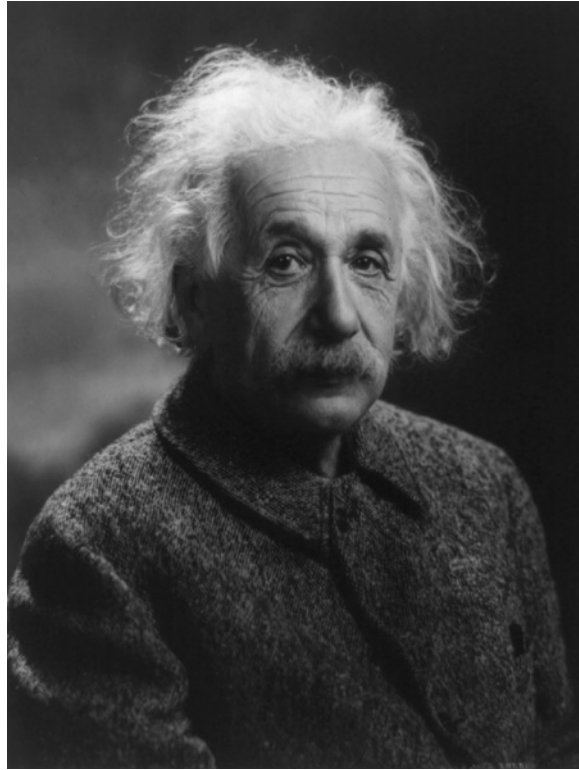


Figure 1.2 Albert Einstein. Image courtesy of the Library of Congress.

It became popular for awhile because it had a delivery system much like an electrosurge, which is similar to what is currently used to cut soft tissue. This laser is still highly favored in the dental industry and used for many different applications; however, one of its major advantages is its use in soft-tissue periodontal procedures.

The one of the most popular laser used in dentistry today is the diode laser. This laser is a soft-tissue laser only, and the active medium is gallium-aluminum-arsenide and other combinations in the form of a chip, which is placed inside the laser itself. It specifically targets melanin and hemoglobin, and to a lesser extent, water during soft-tissue procedures (Figure 1.3).

After Maiman and Einstein, others began researching the use of lasers in dentistry, specifically in regard to the Ruby laser (Goldman et al. 1965; Stern and Sognnaes 1972). According to Goldman (1961), the principles of laser development were first reported by Arthur Schawlow and Charles Townes of the Massachusetts Institute of Technology in 1958, but the Nobel Prize for the development of the laser was awarded to Townes, Nikolay Basov, and Alexander Prokhorov in 1964. It was after this that others became interested in Einstein's theory, but it was Maiman who first developed the

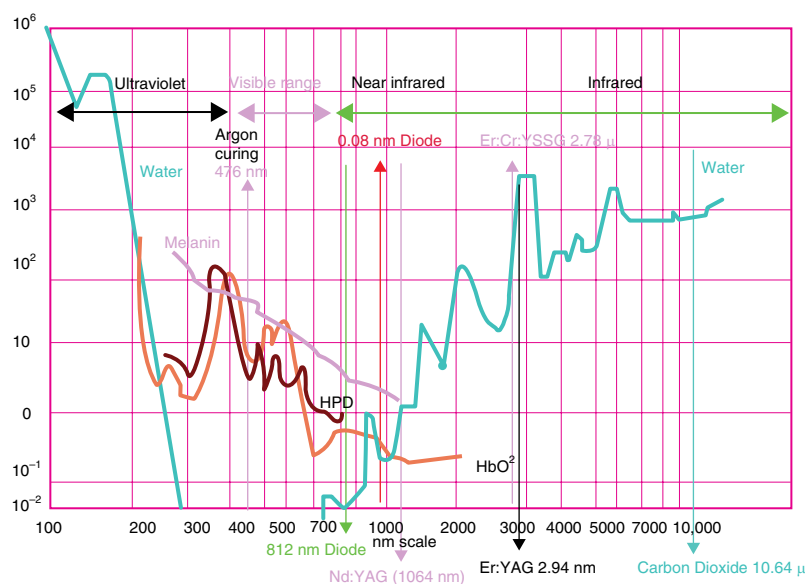


Figure 1.3 Coefficient of absorption for various components in tissue. Er:YAG, erbium: yttrium aluminium garnet; Er:YSGG, erbium: yttrium scandium gallium garnet; Er,Cr:YSSG, erbium,chromium: yttrium scandium gallium garnet; HPD, dialysate of hydropenic plasma; HbO₂, hemoglobin; Nd:YAG, neodymium:yttrium aluminium garnet.

laser and began researching the use of lasers in dentistry, specifically with the introduction of the Ruby laser (Goldman 1965).

From the 1960 to 1990s, lasers were developed, tested, and unsuccessful for use in dentistry. In 1985, Myer and Myers wrote an article about the in vivo removal of dental caries using a modified ophthalmic Nd:YAG laser. Then in 1987, the US Food and Drug Administration (FDA) approved lasers to be used for oral soft tissues. This was a huge step forward in laser technology; however, those in the dental profession were still skeptical. In 1997, the use of lasers on hard tissues was approved; the laser is the Erbium:yttrium-aluminum-garnet (Er:YAG) (FDA 2006).

However, it was when the ND:YAG was approved four years later for soft-tissue removal that led to the initial process in treating periodontal disease. It was this final piece that solidified the relationship between lasers and clinical periodontics (Myers 1989).

The tools are now in place, but there is currently a need for lasers in periodontics as a result of the connection between systemic diseases and gum disease. Dental hygienists are on the frontline and need a higher standard of treatment for their patients using this type of low-level laser therapy (LLLT). The goal is to make these lasers a standard of care in dentistry across the world, while inspiring dental hygienists to become more aware of the available treatments and to base patient care on the overall health of the patient and not just their mouth.

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2

Laser physics

Laser energy is made up of small particles known as photons, which move in waves. Ordinary light as we know it has multiple waves; it is also non-directional and nonfocused.

All lasers are monochromatic, collimated, and coherent. They are one color, and the light is invisible to the naked eye because the laser operates outside of the visible range of the eye. Lasers are highly focused, unidirectional, and efficient; all of which makes them such a dependable tool in dentistry. The aiming beam light, which is in the visible portion of the electromagnetic (EM) spectrum, and its active medium is helium neon (HeNe). This component is added to most lasers so clinicians can visualize where the beam is directed, and the beam can be red, green, or blue.

Wavelength, which is important to the understanding of lasers, is the distance between any two corresponding points on the wave. Each wavelength has some of the same attributes, including velocity, which is the speed of light (186,000 mi/sec), and amplitude, which is the vertical movement of the total height of the wave from peak to peak. Velocity is measured in joules, which is a unit of energy and changes when watts are increased. The wavelength, itself, is the horizontal distance between the points of the wave, from crest to crest or valley to valley. In dentistry, wavelength is measured anywhere from 500 to 10 000nm; a nanometer is one billionth of a meter.

Frequency is another important factor in working with lasers. It is relative to the number of complete oscillations per unit time of a wave and

milli-(m) = 10^{-3} meters
1/thousandth
micron (μ) = 10^{-6} meters
1/millionth
nanometer (nm) = 10^{-9} meters
1/billionth
Example: 700 nm = 0.7 microns

Figure 2.1 Common wavelength measurements.

is measured in hertz, which are units of frequency in cycles per second. Common wavelengths measurements are listed in Figure 2.1.

They include *milli-* (m), which is equal to 10^{-3} meters or 1/thousandth of a meter; micron (μ), which is equal to 10^{-6} meters or 1/millionth of a meter; and a nanometer (nm), which is equal to 10^{-9} meters or 1/billionth of a meter.

An example of these conversions is sometimes dependent on what laser is being used. Some lasers operate in nanometers and some operate in microns. It is important to know how to convert between these two or at the least know when they are equal. For example, 700nm would be 0.7 microns. The change is made by moving the decimal point to the left.

Lasers operate in the EM radiation spectrum and are classified into types according to the frequency of the wave. These types include—in order of increasing frequency—radio waves, microwaves, infrared radiation, visible light, ultraviolet radiation, X-rays, and gamma rays. The behavior of EM radiation depends on its wavelength; this type of radiation is ionizing, which can cause mutagenic DNA changes. Types of this type of radiation are gamma, ultraviolet, and X-rays, which can also be penetrated deeper into the body. Higher frequencies have shorter wavelengths, and lower frequencies have longer wavelengths and are known as thermal radiation. Thermal radiation has no known health related contraindications at this time and includes radio waves, microwaves, and infrared radiation. The soft-tissue lasers that have been discussed for periodontal procedures are near-infrared, invisible, thermal radiation lasers. As a note, the HeNe laser pointer, discussed previously, is in the visible portion of the EM spectrum.

There are three regions (or boundaries) that are relative to laser emission. They are:

- Ultraviolet (1–349 nm)
- Visible (350–750 nm)
- Infrared (750+ nm)

Soft-tissue diode laser wavelengths range from 810 to 1064 nm within the EM spectrum, and the ND:YAG has a wavelength of 1064 nm. Both of these lasers target melanin and hemoglobin, and to a lesser extent, water. A more detailed discussion of how lasers fit into this spectrum is reserved for another chapter.

LASER CLASSIFICATION

There are four different laser classifications, and they numbered as Classes 1, 2, 3, and 4. These classes are further divided into subclasses.

Class 1 lasers are considered to be safe and not able to produce eye damage or risk in the radiation levels when viewed with the naked eye. Class 1M lasers can be potentially hazardous when viewed with cameras, video recorders, microscopes, or magnification loupes.

Class 2 lasers range in the visible spectrum from 350 to 750 nm. These lasers include laser pointers or the HeNe 633 nm built into the dental lasers that allow clinicians to see where they are navigating in the mouth. Its blinking nature protects humans from eye damage from this type of laser. Class 2M lasers have the same characteristics as Class 2; however, they can be potentially hazardous when viewed with cameras, video recorders, microscopes, or magnification loupes.

Class 3 has two subclasses, Class 3R and 3B. When the eye is stable and focused with Class 3R lasers, there is potential hazard with direct or *indirect* reflection of the beam. Class 3B lasers also have the same dangerous potential, but they do not have a potential for a fire hazard as the Class 3R do.

Class 4 lasers are susceptible to many hazards and include: fire, skin, eye, reflection, plume radiation, and air contaminants (Laser Institute of America [LIA] 2007a). See Table 2.1.

LASER SAFETY

When Class 3B and 4 lasers are in use, a laser safety officer (LSO) should be on staff (Table 2.2). These LSOs are responsible for the laser in its totality and in ongoing education and certification with regard to the lasers in use. Before purchasing a laser, check with the manufacturer the type of the laser and to get proper training for *each* model being bought.

According to the American National Standard Institute (ANSI), there are certain terms that should be understood to use a laser safely.

- Maximum permissible exposure (MPE): The level of laser radiation to which an unprotected person may be exposed without experiencing adverse biological changes to the eye or skin.
- Nominal hazard zone (NHZ): The space to which the MPE is being exceeded. This can be an issue for dental offices that have open operator spaces.
- Nominal ocular hazard distance (NOHD): The distance along the axis of an unobstructed beam from the laser, fiber end, or connector to the human eye.
- Optical density (OD): The opacity of the laser protective material; it should be 5 or higher to completely protect the eyes.

Table 2.1 Laser Classifications.

Laser Classification	Content Requirements	Eye Hazards	Dental Wavelength	Laser Safety Officer
Class 1	N/A	Eye safe	Caries detection	No
Class 1M	N/A	Eye safe	Caries detection	No
Class 2	Word <i>caution</i> Colors: yellow and black	Blink response creates safety	Caries detection	No
Class 2M	Word <i>caution</i> Colors: yellow and black	Blink response creates safety	Aiming beams	No
Class 3R	Word <i>Danger</i> , list name, wavelength, and output. Colors: red, white and black		Low-level lasers	No
Class 3B	Word <i>Danger</i> , list name, wavelength, and output. Colors: red, white and black	Eye damage	Low-level lasers	Yes
Class 4	Word <i>Danger</i> , list name, wavelength, and output. Colors: red, white and black	Retinal lesions	Argon 488–514 nm	Yes
		Lens and retinal damage	Diode 810–1064 nm	Yes
		Lens and retinal damage	Nd:YAG 1064 nm	Yes
		Cornea and aqueous flare, lens	Er:Cr:YSGG 2780 nm Er:YAG 2940 nm	Yes
		Cornea	CO ₂ 10 600 nm	Yes

CO₂, carbon dioxide; Er:Cr:YSGG, Erbium:chromium:yttrium scandium gallium garnet; Er:YAG, Erbium:yttrium aluminum garnet; CW, continuous wave; Nd:YAG, neodymium:yttrium aluminum garnet; nm, nanometer.

Class 4 laser beams can reach up to 10 feet, and the Ivoclar Navigator laser beam up to 15 feet; this is why it is important to understand laser effects upon tissue (*see* Table 2.1).

Laser safety must be of utmost importance when lasers are in use. Warning signs should be posted around the work area (Figure 2.2). Additionally, those who use the laser should have the most appropriate eye protection for the particular laser being used (Figures 2.3–2.8). Each individual owner of the laser is responsible for checking with the laser manufacturer and ensuring that the OD is above 5 and that they have the correct laser eye protection with side shields (e.g., goggles, laser loupe magnification offered by Orascoptic, Innovative Optics and Technology 4 Medicine, or the laser manufacturer, which provide inserts for the operator's regular loupes). Proper care of laser safety eyewear is recommended, so that the integrity of the eyewear is not jeopardized. For example, surface

Table 2.2 Laser Safety Officer Responsibilities.

- Oversees the safe practice of the laser and is “keeper” of the key or password.
- Trains the rest of the staff by staying up to date on the latest laser Occupational Safety and Health Administration (OSHA) and American National Standards Institute (ANSI) standards and by taking other continuing education courses as needed.
- Establishes the standard operating procedures for the dental practice in written format.
- Assesses the laser environment for potential hazards.
- Ensures proper eyewear is worn at all times.
- Makes certain laser is shut down when not in use.
- Maintains inventory for the laser and all accessories.
- Posts warning signs and test fires the laser.
- Ensures maintenance, beam alignment, and calibration of the laser.
- Adheres to laser manufacturer’s recommended service schedule.
- Maintains a log of recorded laser use.
- Supervises medical surveillance and incident reporting to the manufacturer and regulatory bodies (i.e., FDA, OSHA).
- Ensures that the laser is being used only within the scope of practice and FDA regulations.
- Makes certain that only authorized and trained personnel use the laser within the scope of their license.
- Determines the nominal hazard zone (NHZ) and the nominal ocular hazard distance (NOHD) zone.

**Figure 2.2** An example of a warning sign.

disinfectants can scratch or degenerate the lens over time. The laser manufacturer should provide instructions on how to clean eyewear effectively, and those instructions should be followed to properly maintain them.

Potential dangers

Eye injuries

Various eye injuries can occur when using lasers (LIA 2007c). Injuries to the cornea can produce a burning, uncomfortable, gritty sensation like sand is in the eye; it also can become painful. Most damage to the retinas goes



Figure 2.3 Laser safety eyewear.



Figure 2.4 Revolution Laser Loupe. Reprinted with permission from Orascoptic.



Figure 2.5 Revolution Laser Loupe with insert, telescopes down. Reprinted with permission from Orasoptic.



Figure 2.6 Revolution Laser Loupe with insert, telescopes up. Reprinted with permission from Orasoptic.



Figure 2.7 Radon Laser Loupe. Reprinted with permission from Orasoptic.



Figure 2.8 Titanium Prismatic Laser Loupe. Reprinted with permission from Orascope.

undetected because the retina has no pain receptors. However, there are some symptoms of retinal damage including the inability to determine colors, trouble reading, and decreased night vision, but perhaps the most concerning damage is blindness (Barat 2006). General eye damage caused by laser can result in headaches, excessive watering of the eyes, and the beginning of retinal detachment.

Laser plume

A laser plume is a potential risk when a laser is in use. A plume is smoke that is emitted from the laser when fired, and it may contain debris with bacterial spores, viruses, human papilloma virus, cancer cells, and herpes. Additionally, the plume can create certain chemicals, such as hydrogen cyanide, formaldehyde, acrolein, and benzene (Canadian Centre for Occupational Health & Safety 2008).

The most recent studies concerning the laser plume have revealed that inhaled nonparticles are a far more toxic than micro-sized particles of the same element, and that these inhaled nonparticles contribute to lung damage and the formation of amyloid plaques (Barat 2006). Additionally, there are now reports that the hazard area for laser-generated air contaminants may exceed the NHZ of 10 feet (LIA 2007b). Exposure to these air contaminants can produce a variety of symptoms, including coughing, watery eyes, burning eyes, nasal congestion, nausea, vomiting, chest tightness, fatigue, abdominal cramping, and flu-like symptoms (Canadian Centre for Occupational Health & Safety 2008).

When a laser creates a plume, it is vitally important that the operator use a high-volume evacuation and a high-filtration Class 5 mask. Studies report

safer usage by maintaining the evacuation tube as close as 1 cm from the area working with the laser (Fisher 1987). Operators should always use the lowest power necessary to achieve the most results when using the laser.

Fire

Fire hazards are not likely within a usual dentistry setting; however, they are a concern while using a laser. Because all lasers that are used in dentistry are within the visible and invisible near-infrared EM spectrum and therefore, produce thermal radiation, it should be kept in mind that as the temperature rises within a laser, the risk of fire is heightened. However, the risk is only when the laser beam makes contact with combustible materials or gases. ANSI has revised their thoughts on the use of nitrous oxide while using the laser; it is now allowed as long as a closed-circuit delivery system in use and the scavenging system is connected to the high-volume evacuation tube (ANSI 2005). It is important that those who use oxygen tanks place their tanks outside the NHZ range of 10 feet. Dentists and dental hygienists should be aware not to use alcohol-based products because they are flammable and increase the possibility of fire. Additionally, oil-based products should not be used while using the laser. For example, petroleum jelly (oil based) should not be used on the lips. Fire extinguishers and a sink with working water should *always* be easily accessible when using the laser.

Skin damage

Skin damage is now considered rare as a result of the standards put in place by the Occupational Safety and Health Administration (OSHA) for dental personnel. These include dental professionals completely covering exposed skin. Even with the best precautions, skin can be exposed and result in blisters, burns, or excessively dry skin.

Infection control

Proper infection control is important to understand when using a laser because there is a great risk for transmitting infection between patients if the laser is not properly sterilized or cleaned after *every* use. In particular, quartz tips, optic fibers, laser handpieces, and sapphire tips should be sterilized *with* heat after *each* patient use (Kohn et al. 2003). Any fiber that is cleaved (cut off with the cleaving instrument) or any disposable fiber tip should be properly disposed of in the sharps container. If a disposable plastic tip is used and has any blood on it, it also should be placed in the biohazards or sharps container. After the tip or laser fiber has been cleaved and properly disposed of, the laser fiber and handle can be wiped down with a high-level disinfectant. Maintaining a plastic sleeve over the handle when the laser is in use is recommended. However, each laser is developed differently and each has its own disinfection routine that should be

followed. Always check with the laser manufacturer for the correct infection control for the laser in use.

Safety controls

Lasers come equipped with safety mechanisms and controls that the manufacturers put in place to reduce potential hazards. These include, but are not limited to:

- a. On/off key or password preventing the lasers from being used or turned on unless by an authorized personnel.
- b. Safety interlock that serves as a mechanism on the panels and protective housing within the laser; it cannot be removed.
- c. Remote interlock jacks that allow the laser to be shut off if the door to the operatory space is connected to the laser and is opened during use; this is used more internationally.
- d. Guarded foot pedal that helps to prevent the operator from accidentally stepping on the foot pedal and activating the laser.
- e. Emergency stop button that allows the laser to be stopped at any time during use.
- f. A system time-out that activates a standby mode for the laser.
- g. Audible warning sounds that sound off when the laser is activated and in use.
- h. Visible warning signs that indicate the laser is firing.

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3

Laser components

THE LASER COMPONENTS

All types of lasers are made with the same components, the specifics, however, vary. All lasers have the following five components:

1. Active medium, which are materials in the core of the laser, can be gas, solid, liquid, or crystals and are usually the name the laser.

Gas lasers use carbon dioxide, argon, krypton, and mixtures, such as helium-neon. These lasers are often pumped by electrical discharge. Solid lasers use crystals and glasses. The solid *host* materials are usually doped with an impurity such as chromium, neodymium, erbium, or titanium ions. Typical hosts include yttrium aluminum garnet (YAG), yttrium lithium fluoride (YLF), sapphire (aluminum oxide), and various glasses. Solid-state lasers use Nd:YAG, Ti:sapphire, Cr:sapphire (usually known as ruby), chromium-doped lithium strontium aluminum fluoride (Cr:LiSAF), Er:YLF, Nd:glass, and Er:glass. These lasers are usually pumped by flashlamps or light from another laser. Liquid lasers use liquid dye. These lasers include a tunable-dye laser, which can provide wavelengths from 400 to 1000 nm, depending on the composition of the liquid dye.

Semiconductors are a type of solid laser, in which the movement of electrons between materials with differing dopant levels can cause laser action. Semiconductor lasers are typically small and can be pumped with a simple electric current, enabling them to be used in

Table 3.1 Lasers and Their Characteristics.

Laser Type	Wavelength	Color	Active Medium	Major Biological/ Chemical Absorber (1–11)	Prevalent Delivery System	Prevalent Emission Mode	Eye Structure Affected
ArF Excimer	193 nm	Ultraviolet (Invisible)	Gas	Water, collagen, albumin, keratin sulfate (12), hydro9 apatite	Conventional fixed mince and lens system	Pulsed	Cornea
KrF Excimer	2421 nm	Ultraviolet (Invisible)	Gas	Melanin, hemoglobin, water, and hydroxyapatite (weak)	Articulated arm	Pulsed	Cornea
XeO Excimer	3013 nm	Ultraviolet (Invisible)	Gas	Melanin, hemoglobin	Optic fiber	Pulsed	Cornea
Alexandrite	377 nm	Ultraviolet (Invisible)	Solid	Melanin, hemoglobin, calculus (13)	Optic fiber	Pulsed	Lens
Argon Ion	483 nm 515.5 nm	Blue, green	Gas	Camphor Quin one (14), xanthophyll (US nm), hemoglobin and melanin (488 and 514.5 nm)	Optic fiber	CW	Retina
HeNe	632 nm	Red	Gas	Melanin	Optic fiber, articulated arm	CW	Retina
Ruby	6943 nm	Deep red	Solid	Melanin	Lens system, articulated arm	CW and pulsed	Retina
Diode	605 420 nm	Near infrared (invisible)	Solid	Melanin, water, hemoglobin (weak)	Optic fiber	CW and pulsed	Lens and retina
Nd:YAG and Nd:Cr:GSGG	1.064 nm 1.061 nm	Near infrared (invisible)	Solid	Melanin, water, dentin, oxygenated hemoglobin (weak)	Optic fiber	Pulsed or CV	Lens and retina
Ho:YAG	2.12 vs. 2–12 nm	Near infrared (invisible)	Solid	Water, dentin	Optic fiber	Pulsed	Cornea, aqueous, and lens
Erbium:YSSG and Erbium:YAG	2.71 nm 2.14 nm	Near infrared (invisible)	Solid	Water, hydroxyapatite (2.71 and 2.94 pm), collagen (2.94 pm)	Articulated arm, optic fiber	Pulsed	Cornea, aqueous, and lens
CO ₂	93, 9.6 nm	Mid-infrared	Gas	Hydroxyapatite, water	(Invisible) lens system	Pulsed	Cornea

ArF, argon fluoride; CO₂, carbon dioxide; CW, continuous wave; HeNe, helium neon; Ho:YAG, holmium:yttrium aluminum garnet; KrF, krypton fluoride; Nd:Cr:GSGG, neodymium:chromium:gadolinium scandium gallium garnet; Nd:YAG, neodymium:yttrium aluminum garnet; nm, nanometer; XeO, UHV xenon.

consumer devices such as compact disc players. An example of a semiconductor is a soft-tissue diode laser (Table 3.1).

2. Pumping mechanism, which develops a population inversion in the active medium (electrical current discharge [e.g., carbon dioxide]).
3. Optical resonator, which amplifies and collimates the developing laser beam.
4. Cooling subsystem.
5. Controller subsystem (microprocessor).

Additionally, each laser has operating parameters that are unique, and they include:

Energy per pulse, if appropriate.

Repetition rate duration of exposure.

Power.

Spot size fiber size.

Energy density amount of energy delivered to the tissue surface area.

Total energy for procedure

EMISSION MODES

Lasers have a variety of emission modes, which are ways that the laser can operate.

The first emission mode is continuous wave (CW). When the foot pedal is depressed, the laser beam will fire (turn on), until the foot pedal is not pushed.

The next emission mode is chopped or gated; it has a mechanically closing door that allows the clinician to control the duty cycle, for instance, it may be at 50% on and 50% off.

There is also a laser that operates at a free-running pulsed rate, which is in short bursts of energy, dependent on the excitation source in the dental laser. This laser operates at a low level of energy until the burst, which is usually 1000 watts.

Lasers have these emission mode options for various reasons. Time is always a restraint in the dental world; using the laser in CW mode is beneficial. Occasionally the laser can be used in gated or pulsed mode; this is to allow tissue relaxation.

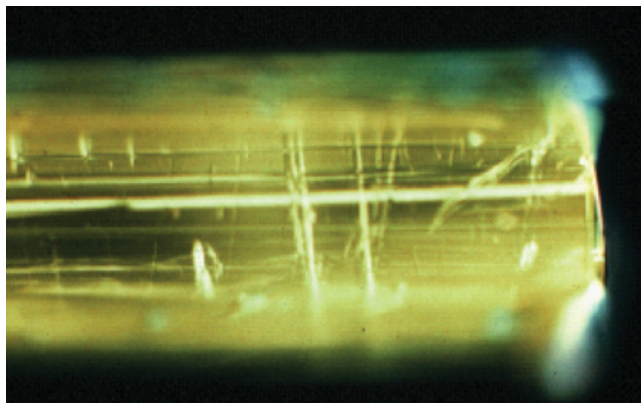
TYPES OF POWER AND CYCLES

Duty cycle is equal to emission and is expressed in a percentage of what the laser is actually firing in relation to total laser activation time.

Average power is power on a sustained basis, whereas peak power is power level during the pulse. Power density is watts/cm² and is the

Laser–Tissue Interaction

$$\begin{aligned}
 &\text{Power Intensity} \\
 + &\text{Exposure Time} \\
 + &\text{Spot Size} \\
 \hline
 &\text{Power Density (W/cm}^2\text{)}
 \end{aligned}$$

Figure 3.1 Laser tissue interaction.**Figure 3.2** A properly cleaved fiber.

concentration of photons in a unit area. It measures the laser beam power per surface area.

Fluence is joules/cm² (energy density), which is equal to the diameter of the spot, and decreases as a function of the working distance. Laser fluency in light-based medicine and dentistry may be more properly referred to as radiant exposure and is a measurement of energy over area. This area is usually the spot size of the light device. The higher the fluence, the more “cutting power” a laser has.

However, it is the fibers (measured in microns) that determine the amount of energy that is placed through the tip. Fiber sizes are 200, 300, 400 or 600 micron fibers.

Power density measures the laser beam power per surface and is what determines the rate of tissue removal (Figure 3.1).

One important factor in determining the spot size is to ensure that the fiber has been correctly cleaved. This will allow the most efficient and effective energy through the fiber. A jagged or broken fiber will lose the efficiency of laser energy and could cause injury to the patient (Figures 3.2–3.5).

Beam divergence, on the other hand, is the property in which the beam diameter of the laser light increases with the distance from the laser. A highly directional laser has a low divergence.

There are also two modes of use with each laser, contact mode, which allows a narrow deep incision, and noncontact mode, which provides a shallow broad ablation.

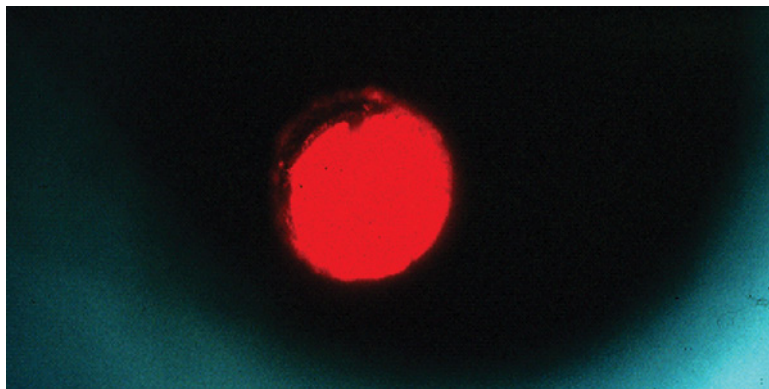


Figure 3.3 Aiming beam of a well-cleaved fiber.

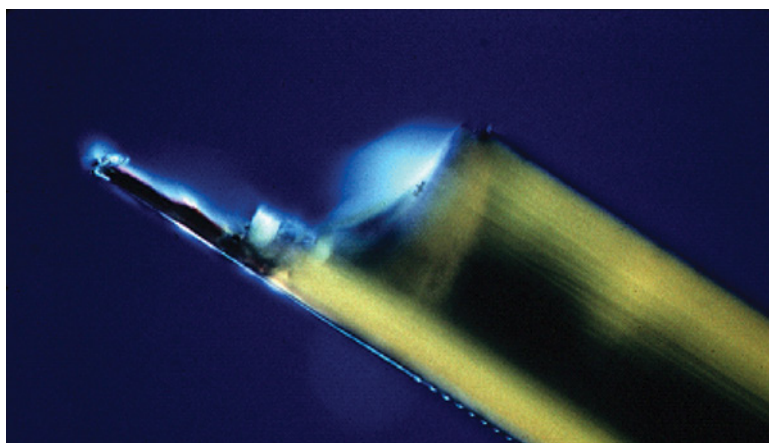


Figure 3.4 A poorly cleaved fiber.



Figure 3.5 Aiming beam of a poorly cleaved fiber.

TISSUE EFFECTS

Lasers also have four tissue effects: reflection, transmission, scattering, and absorption. Reflected laser energy is dependent on tissue type, and this causes the laser to have no effect on tissue. Caution must be used with reflection and mirrors. Scattered laser energy is dependent on wavelength absorption and may obscure desired effect; however, this will reach connective tissues. Transmitted energy is dependent on wavelength, avoids surface interaction (like retinal surgery), and energy travels with no effect dependent on tissue type. Absorption is dependent on laser wavelength, tissue composition, pigmentation, and water content. Short wavelength lasers are absorbed primarily in hemoglobin and melanin, and longer wavelength lasers are absorbed by water or carbonated hydroxyapatite. It is in absorption that laser light is converted to heat. Absorption is the most important of all of the interactions for the laser to be able to perform within the periodontal sulcus. When the laser energy is *absorbed*, it creates different tissue temperatures and changes into heat (Figure 3.6).

Changes with heat

Changes take place on the dental tissues dependent on the laser energy that is placed into the tissue. At 37–50°C, hyperthermia and edema take place. This setting is used when a laser is used for herpetic lesions and aphthous ulcers. No change in tissue color or appearance will occur because this setting is used mainly for wound healing.

Heat less than 60°C, coagulation and protein denaturation occur, and this is when dental hygienists use the laser to destroy bacteria and remove diseased tissue. Coagulation and protein denaturation are the desired results and are indicative with a tissue color change from magenta to dark pink to healthy pink.

Anything above these ranges are procedures only a dentist is allowed to perform. From 70 to 150°C, welding-carbonization occurs. This is not a

Thermal Effect of Laser on Tissue

Tissue Temperature(°C)	Observed Effect
37–50	Hyperthermia, Edema
60	Coagulation, Protein denaturation
70–90	Welding, Dehydration
100–150	Vaporization, Ablation
greater than 200	Carbonization

Figure 3.6 Thermal effect of laser on tissue.

desired effect when working on the periodontal infected tissue; colors start to change from healthy pink to gray to white and then charring occurs. These ranges include 70 to 90° C, in which welding and dehydration take place. And from 100 to 150° C, vaporization and ablation takes place. Anything greater than 200° C will create carbonization. Carbonization or charring of the tissue is not a biological bandage in healing.

TISSUE INTERACTIONS

There are four basic tissue interactions that take place with lasers, and they are photochemical interaction, photothermal interaction, photomechanical interaction, and photoelectrical interaction.

Photochemical interactions include biostimulation, which is a stimulatory effect of laser light on biochemical and molecular processes that normally occur in tissue, such as healing and repair. Examples of this are pain relief, wound healing, and collagen growth. Biostimulation increases circulation, collagen, and osteoblastic and fibroblastic formation, which initiates healing. It also stops the inflammatory response from the top down and allows for removal of the infected sulcular epithelium while gaining attachment from the bottom up.

Photothermal interactions include photoablation, which is the removal of tissue by vaporization and superheating of tissue fluids (coagulation), and photopyrolysis, which is the burning away of tissue (vaporization).

Photomechanical interactions include photodisruption, which is the breaking apart of structures by laser light, and photoacoustic, which is the removal of tissue with shock-wave generation.

Photoelectric interactions include protoplasmolysis, which is when tissue removed through the formation of electrically charged ions and particles that exist in a semi-gaseous, high-energy state along with plasma.

LASER DELIVERY SYSTEMS

Each laser has a unique delivery system. The options that are available are fixed lens and mirror, articulated arm, hollow waveguide, optic fiber or a handheld, low-level laser.

Fixed lens and mirrors, as well as articulated arm, lasers are used for longer wavelengths, such as erbium and carbon dioxide. They are a series of rigid tubes connected through precision flexible mirror joints, which conduct the laser beam.

A hollow waveguide is used for longer wavelengths and also for use with erbium and carbon dioxide. A fiber-optic system is used for short wavelength lasers, such as diode and Nd:YAG.

The next chapter discusses all of the lasers available in dentistry.

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4

Lasers available in dentistry

The US Food and Drug Administration (FDA) has cleared the use of the types of lasers discussed in this chapter for dental use. These are carbon dioxide (CO₂), erbium, neodymium:yttrium-aluminum-garnet (Nd:YAG), argon, holmium:yttrium-aluminum-garnet (Ho:YAG), and the diode lasers. Dental lasers are a family of instruments; some are used for surgery; some cure restorative materials and enhance tooth bleaching; and others remove tooth structure for elimination of disease and restoration.

DIFFERENT LASERS FOR DIFFERENT PROCEDURES

Lasers available in dentistry today are soft- and hard-tissue lasers. The diode and the Nd:YAG lasers will be discussed in more detail throughout this chapter, whereas the other lasers discussed will have a briefer description. The reader is encouraged to research any specific laser that is mentioned herein that meets specific dental needs.

Each type of laser discussed operates on the electromagnetic (EM) spectrum (Figures 4.1–4.3; Table 4.1).

Alexandrite laser

The Alexandrite laser, 377 nm, is not readily available in the United States at this time; however, it may become available at a later time.

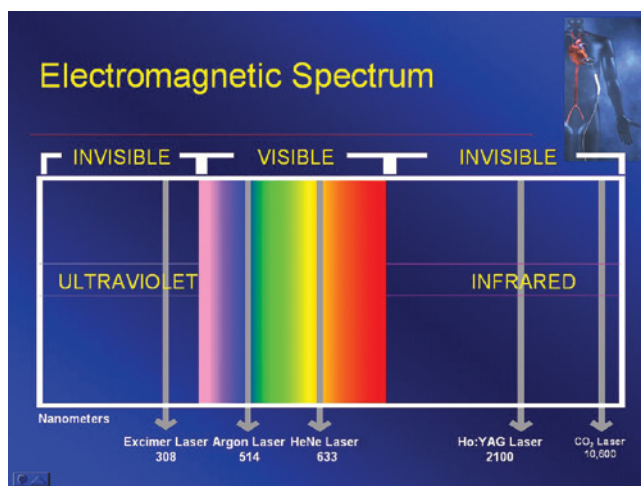


Figure 4.1 Electromagnetic spectrum.

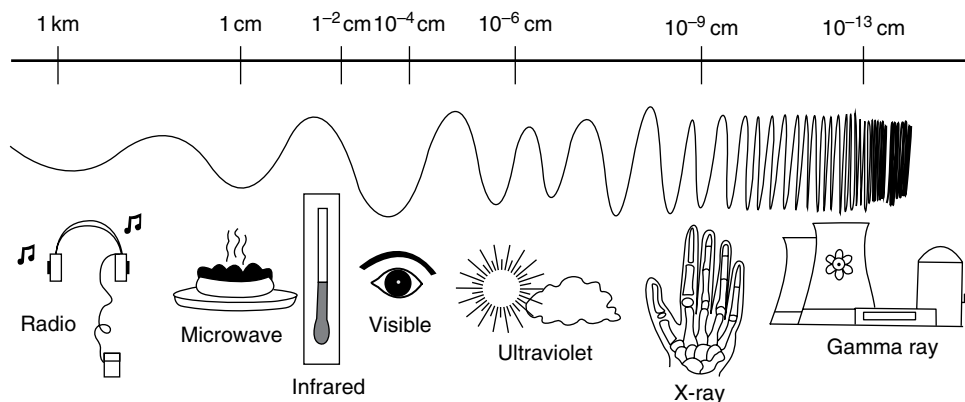


Figure 4.2 Electromagnetic spectrum. Image courtesy of NASA.

Argon laser

The Argon laser, 488–515 nm, is used for minor surgery and has an active medium of argon gas. With this laser, the energy passes through the laser's ion gas head and is reflected off mirrors. It then generates laser light that is directed through a flexible silica-quartz fiber, which allows for easy use by the dental clinician. However, the argon laser is used primarily for surgery, composite resin placement, enamel and dentin bonding procedures, preventive dental therapies, and endodontic procedures. This laser is located in the visible green and blue portion of the EM spectrum and because of these short wavelengths it can be focused onto a small area. A

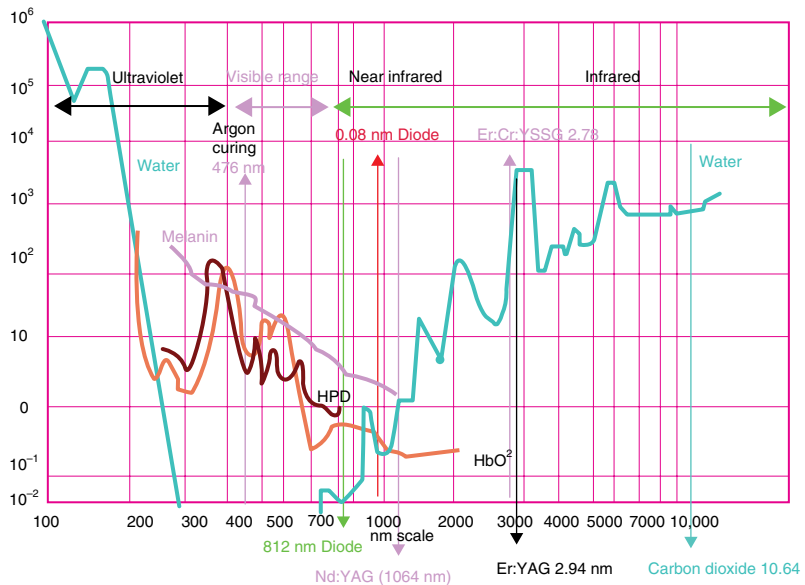


Figure 4.3 Coefficient of absorption for various components in tissue.

Table 4.1 Coefficients of Soft- and Hard-Tissue Lasers and Absorption Characteristics of Dental Lasers.

Laser Type	Wavelength	Active Medium	Major Biological/ Chemical Absorbed
Alexandrite	377 nm	Solid	Calculus
Argon	488–515 nm	Gas	Hemoglobin
HeNe	632 nm	Gas	Melanin
Diode	812–1064 nm	Solid	Melanin, hemoglobin
Nd:YAG	1064 nm	Solid	Melanin, water, dentin
Ho:YAG	2120 nm	Solid	Water, dentin
Erbium	2790–2940 nm	Solid	Water, hydroxyapatite
CO ₂	9.3, 9.6, 10.6 nm	Gas	Water, hydroxyapatite

CO₂, carbon dioxide; HeNe, helium neon; Ho:YAG, holmium:yttrium aluminum garnet; Nd:YAG, neodymium:yttrium aluminium garnet.

great deal of energy goes into this laser and because of its low efficiency, a great deal of heat is produced, and it must be removed frequently during use to avoid blistering. High-power (more than 3 watts) Argon lasers should be used with a water cooling system. The Argon laser has been invaluable to a broad spectrum of dental surgeries, that is, until diode lasers became more prevalent. It absorbs melanin and hemoglobin, like diode lasers, and has many of the same applications. However, it is in the visible portion of the EM spectrum. It also has the versatility to vaporize,

coagulate and cut (Dixon, Davis, and Gilbertson 1986; Hohenleutner and Landthaler 1991; Neumann and Knobler 1990).

He:Ne laser

The He:Ne laser, 633nm, is one that most consumers recognize. One example of this laser is simply a laser pointer that is combined with many of the lasers in dentistry. It allows the dental professional to see where he or she is aiming the laser and what needs to be accomplished during a procedure in the oral mucosa.

Diode laser

The diode laser, 812–1064nm, is a solid laser that has a semiconductor chip that works like an electrical diode. The energy of a diode laser can cut soft tissue and reduce bacterial counts in the periodontal pockets (Gross 1994). There is evidence that the diode laser may reduce both gingival inflammation and the need for local anesthetic during surgical procedures (Lin, Beck, and Matsue 1992; Tam 1999). The active region of this laser, the diode, is a made up of many layers of different semiconductor materials. The first layer is a p-type material, which is a carrier of positive charge or electron holes; next is a nonconductive band-gap layer, which is the junction; and then an n-type material, which is the negative charge or free electrons. If a negative voltage is applied to the n material and a positive voltage is applied to the p material, this sends a flow into the junction and electrons fall into the holes and energy is released.

Most of the time, the energy is released as heat because these lasers are in the thermal radiation category and have wavelengths in the red and near infrared on the EM spectrum (Pick 1993). Diode lasers have a nonionizing effect on tissues, so therefore they are nonmutagenic. The energy can also be released in materials such as gallium, aluminum, and arsenide as a photon. These types are light-emitting diodes (LEDs) and are delivered to the oral cavity through an optic fiber and can be either in continuous wave (CW) or pulsed mode. The diode wavelengths are determined by the semiconductor material and the operating temperature. Each diode laser has a different output power from machine to machine. Additionally, for a diode laser to operate, it must have a reflective surface at either end of the junction to establish an optical cavity and be absorbed into its target tissues.

A diode laser absorbs melanin and hemoglobin as its target tissues, which makes it only for soft-tissue applications. The laser energy is absorbed by tissue and allows for surgical excision and coagulation to occur. This photothermal effect takes place when the laser light (laser energy) is absorbed by tissue and converted into heat, which enables tissue temperatures to rise. This device, then, can be used in place of the scalpel and electrosurge within dentistry for better photobiological effects (e.g., healing, biostimulation, less bleeding, and more comfort) of the tissue.

This particular laser works well for dark pigmented areas, such as diseased tissue. Because of the specificity of lasers is that they focus only on these target tissues, it will leave healthy tissue alone and only seek infected tissue, melanin, and hemoglobin when used under the correct parameters. Additionally, the output from several diodes in an array can be combined to boost output power up to 100 watts (Pick, Pecaro, and Silberman 1985). However, for dental use, the power output should generally be used on CW from 0.6 to 2 watts and on the pulsed mode from 1.5 to 7 watts.

In comparable studies, the diode laser has been shown to have similar tissue effects as the Nd:YAG laser but with less thermal effects on the deeper tissues (Rastegar et al. 1992; Wyman et al. 1992). Thus, the diode laser is one of the most popular lasers used in dentistry at this time. Some of the clinical applications used with this laser are:

- Troughing
- Gingivectomy
- Class V gingivoplasty
- Implant recovery
- Aphthous ulcers
- Laser curettage
- Incision and excision
- Frenectomy
- Fibroma
- Incision and draining of abscess
- Biopsies
- Operculectomy
- Exposure normal tissue
- Exposure fibrous tissue
- Molar exposure
- Hyperplasia
- Access gingivectomy
- TAD (minimal) recovery

Nd:YAG laser

The Nd:YAG laser, 1064nm, is a solid-state laser that has a lasing medium suspended into a garnet crystal, which contains yttrium and aluminum that are used for *all* YAG lasers and specifically for this neodymium laser. The energy used in the YAG lasers produces more energy than those in the carbon dioxide (CO₂) lasers and this allows the wavelengths to be shorter and near infrared, which has a nonionizing effect on tissues and are therefore nonmutagenic. These YAG lasers are delivered using an optic fiber to the oral cavity and can be either in CW mode or pulsed mode. However, most of the time, they are used in the free-running pulsed mode (Myers and Myers 1985). The ability to perform procedures at a low-level power setting

creates for a unique machine and a positive feature of the free-running pulsed mode because the aim should always be to use the smallest amount of energy to achieve therapeutic goals. The YAG portion (crystals) of the laser is the about the size of an adult pinky finger and a small amount of neodymium is impregnated into the surface of the crystal. The Nd:YAG absorbs melanin, water, and dentin as its target tissues. This laser can be used to remove carious lesions without damaging the surrounding tooth enamel and with minimal discomfort. In addition, this laser is used for many other dental applications:

- Caries removal
- Troughing
- Gingivectomy
- Class V gingivoplasty
- Implant recovery
- Aphthous ulcers
- Laser curettage
- Incision and excision
- Frenectomy
- Fibroma
- Incision and draining of abscess
- Biopsies
- Operculectomy
- Exposure normal tissue
- Exposure fibrous tissue
- Molar exposure
- Hyperplasia
- Access gingivectomy
- TAD (minimal) recovery

This laser works much the way that the diode laser does. The interaction of the laser wavelength and energy density with the tissue at the tip of the fiber optic allow for cutting and coagulation of the tissue. This can be used in place of the scalpel and electrosurge for better photobiological effects (e.g., healing, biostimulation, less bleeding, and more comfort) of the tissue. The laser energy is absorbed by tissue, and this is what allows for surgical excision and coagulation of tissue to occur. This photothermal effect occurs when this laser light (laser energy) is absorbed by tissue and converted into heat, which enables tissue temperatures to rise.

Ho:YAG laser

The Ho:YAG, 2120 nm, is a solid-state laser and is part of the YAG family as well and has a lasing medium suspended into a garnet crystal, which contains yttrium and aluminum that are used for *all* YAG lasers specifically for this holmium laser. This laser is mostly used in medical, not dental,

settings. However, it is approved to be used in dentistry for soft tissue and may have good potential for hard tissue as well. This is because of its versatility and unique characteristics (Mani 1992). In the medical arena, the Ho:YAG is used in vascular surgery, neurosurgery, ophthalmology, angioplasty, urology, laryngology, gastroenterology, orthopedics, bone removal during dacryocystorhinostomy, and arthroscopy (Trauner, Nishioka, and Patel 1990; Vari et al. 1991). This holmium laser has characteristics of both the Nd:YAG and the CO₂ lasers. Its delivery mode is through a flexible bare quartz optic fiber. And like the CO₂, it can ablate soft tissue quickly; however, it offers better hemostasis and is safe and effective to use on bone and cartilage.

Erbium laser

The erbium lasers, 2790–2940 nm, absorb water and hydroxyapatite and has an emission wavelength that coincides with the main absorption peak of water, which results in good absorption in all biological tissues, including enamel and dentin. This laser cuts hard tissues using microexplosions of water. This process of ablation leads to little thermal increase within the hard tissue (Hirbst 1988; Keller 1989). It is thought that this laser can work on healthy tissues and dental caries without causing thermal injury to the surrounding areas being worked on. Because this laser is used for hard tissue, it will not be discussed any further.

CO₂ laser

The CO₂ laser, 9.3–10.6 μm, works on slightly different principles in that the molecules store energy in vibrational as well as electrical modes, which could produce spontaneous or stimulated emission. The lasing medium for this laser contains a mixture of CO₂, nitrogen, and helium gases and is dispersed as a gas (Pick 1993). Most importantly with this laser is that if the electric output is maintained through the lasing medium, the molecules start to take action and are pumped up. But because of this, a population inversion and a continuous laser output are maintained, and it develops a collimated beam that can reach an extremely long distance. The CO₂ laser can manufacture a train of pulses having durations of tens to hundreds of millionths of a second. The train of super pulses may be gated (opening and closing of the shutter) with the mechanical shutter within the machine. This all occurs when the foot pedal is depressed. This laser is the first generation of lasers that still offers the clinician a variety of advantages, including little or no bleeding, a dry operating field, excellent visibility, possible reduction in operative time, reduced swelling, improved coagulation, reduced pain, decreased scarring, little or no need for sutures, little change for mechanical trauma, and high patient acceptance.

It operates in the noncontact mode and absorbs water and hydroxyapatite as its target tissues; additionally, it can be used in soft-tissue applications.

Furthermore, CO₂ lasers can be used for biopsies (Pick et al. 1985), but they do run the risk of producing a significant char layer (Apfelberg 1985).

CURRENTLY MANUFACTURED LASERS

There are many different companies that produce soft-tissue diode lasers. However, most diodes will produce the same result if used consistently under the same parameters. It is also important for the hygienist to have a basis of these companies and their units to make the most informed decision about what unit may be best for their practice.

Zila

Soft lase 3

Zila produces the only desktop diode laser, the Soft Lase 3 (Figure 4.4). It offers many high-end features and is engineered by the same innovators of the award-winning NV Microlaser. The Soft Lase 3 delivers advanced portability, convenience, and ease of use.

Product specifications

- Weight: 1.85 lbs
- Dimensions: 5.5" × 7.0" × 5.5"
- Active medium: GaAlAs laser diode
- Wavelength: 808+–5 nm



Figure 4.4 Soft Lase 3. Reprinted with permission from Zila, Inc.

- Operation mode: CW and pulsed at 10Hz
- Output power: 3.0W (maximum)
- Delivery system: 400-micron Unifiber™ system with disposable fiber tip
- Activation: 2.4GHz RF wireless foot pedal
- Power source: 100–240 VAC, 0.8 A Max, 50–60hz, or rechargeable li-ion battery
- Aiming beam: 650-nm red diode
- Voice confirmation: Yes

Clinical applications

- Troughing
- Gingivectomy
- Class V gingivoplasty
- Implant recovery
- Aphthous ulcers
- Laser curettage
- Incision and excision
- Frenectomy
- Fibroma
- Incision and draining of abscess
- Biopsies
- Operculectomy
- Exposure normal tissue
- Exposure fibrous tissue
- Molar exposure
- Hyperplasia
- Access gingivectomy
- TAD (minimal) recovery

NV Microlaser™

The NV Microlaser™ (Figure 4.5) delivers the full power and capabilities of a much larger desktop soft-tissue laser in a smaller size. The NV Microlaser™ is lightweight (1.9oz) and is a self-contained, all-in-one, wire-free handheld device.



Figure 4.5 NV Microlaser. Reprinted with permission from Zila, Inc.

Product specifications

- US Patent: D587,803
- Weight: 1.9 ounces
- Dimensions of laser: 6.3" L $\times$ 0.65" diameter
- Active medium: GaAlAs laser diode
- Wavelength: 808 $\pm$ 5 nm
- Operation mode: CW and pulsed at 10 Hz
- Output power: 2.0 W (maximum)
- Delivery system: 400-micron fiber with built-in disposable tip
- Audible notification: Yes
- Visual notification: Yes
- Preset procedures: Yes

Clinical applications

- Periodontal therapy (laser-assisted periodontal therapy)
- Crown troughing
- Operculectomy
- Gingivectomy
- Implant recovery
- Frenectomy
- Operculectomy
- Class V Gingival contouring

NV Ortho

NV Ortho is a small device that has the power and capabilities of much larger desktop soft-tissue lasers. The NV Ortho is an all-in-one, wire-free handheld device that weighs only 1.9 ounces and is self-contained. Additionally, the NV Ortho has custom orthodontic presettings and disposable fiber tips.

Product specifications

- Weight: 1.9 ounces
- Dimensions of laser: 6.3" L $\times$ 0.65" diameter



Figure 4.6 NV Ortho.

- Active medium: GaAlAs laser diode
- Wavelength: 808 +/−5 nm
- Operation mode: CW and pulsed at 10 Hz
- Output power: 2.0 W (maximum)
- Audible notification: Yes
- Visual notification: Yes
- Preset procedures: Yes

Clinical applications

- Bicuspid exposure
- Hyperplasia
- Periodontal therapy (laser-assisted periodontal therapy)
- Crown troughing
- Operculectomy
- Gingivectomy
- Implant recovery
- Frenectomy
- Operculectomy
- Class V gingival contouring

IVOCLAR

Ivoclar Vivadent, Inc. produces the Odyssey® soft-tissue diode lasers. These lasers have unique features such as an automated fiber management system, wireless foot control, unit-dose fiber tips, touch screen, and battery operation.

The Odyssey lasers cut and coagulate at the same time, thereby facilitating immediate hemostasis, less tissue charring, less postoperative healing time, and fewer postoperative complications, including less chance of infection. These lasers can also be used for *minor* surgical procedures, and tissue procedures around the gingiva can even be done without anesthesia.

Odyssey® 2.4G diode laser

The Odyssey® 2.4G diode laser combines 810-nm laser wavelength with user-friendly features and consistency and safety for clinicians and patients alike.

Product specifications

- Aiming beam: Red with five levels of control
- A 630-nm laser pointer
- Operation mode: CW and pulsed
- Output power: 3 mw



Figure 4.7 Odyssey® 2.4G laser. Reprinted with permission from Ivoclar Vivadent, Inc.

- Activation: Wireless foot pedal
- Power source: 9-v lithium battery

Navigator

The Odyssey® Navigator is another Ivoclar Vivadent, Inc. soft-tissue laser. However, it is a portable diode laser with a docking cradle that secures the laser on a countertop and provides a charging base for the rechargeable battery.

Product specifications

- Wavelength: 810 nm
- Output power: 3 W
- Activation: Wireless foot pedal
- Power source: Lithium ion battery
- Touch screen monitor
- Ergonomic handpiece design
- Inverted screen capability
- Unit-dose fiber tips
- More than 30 preset clinical procedures



Figure 4.8 Odyssey® Navigator laser. Reprinted with permission from Ivoclar Vivadent, Inc.

AMD LASERS

Piccaso

The Piccaso laser is manufactured by AMD Lasers and is another soft-tissue diode laser. This laser is used for a wide range of soft-tissue surgical, periodontal, endodontic, and whitening procedures.

Product specifications

- Output power 7.0 W
- Operation mode: CW and pulsed
- Power source: 100–240 V, 50–60 Hz
- 8 presets
- Touch screen
- Adjustable aiming beam

Clinical applications

- Laser periodontal
- Laser soft-tissue curettage
- Laser removal of diseased, infected, inflamed, and necrosed soft tissue within the periodontal pocket
- Removal of inflamed edematous tissue



Figure 4.9 Picasso laser. ©AMD LASERS.

- Sulcular debridement
- Laser aesthetics and surgery
- Exposure of unerupted teeth
- Fibroma removal
- Frenectomy and frenotomy
- Gingival troughing for crown impressions
- Gingivectomy and gingivoplasty
- Gingival incision and excision
- Hemostasis and coagulation
- Implant recovery
- Incision and drainage of abscess
- Leukoplakia
- Operculectomy
- Oral papillectomies
- Reduction of gingival hypertrophy
- Soft-tissue crown lengthening
- Treatment of canker sores and herpetic and aphthous ulcers of the oral mucosa
- Vestibuloplasty
- Laser teeth whitening



Figure 4.10 Picasso Lite laser. ©AMD LASERS.

Picasso lite

The Picasso Lite can be used for a wide range of soft-tissue surgical, periodontal, and endodontic procedures. It is also useful for first-time laser users and can replace electrosurge.

Product specifications

- Output power: 2.5 W
- Operation mode: CW and pulsed
- Power source: 100–240 v, 50–60hz
- 3 customizable presets
- Membrane screen
- Adjustable aiming beam

Clinical applications

- Laser periodontal
- Laser soft-tissue curettage
- Laser removal of diseased, infected, inflamed, and necrosed soft tissue
- Removal of inflamed edematous tissue
- Sulcular debridement
- Laser aesthetics and surgery
- Exposure of unerupted teeth



Figure 4.11 EZ Lase laser. Reprinted with permission from Biolase Technology Inc.

- Fibroma removal
- Frenectomy and frenotomy
- Gingival troughing for crown impressions
- Gingivectomy and gingivoplasty
- Gingival incision and excision
- Hemostasis and coagulation
- Implant recovery
- Incision and drainage of abscess
- Leukoplakia
- Operculectomy
- Oral papillectomies
- Reduction of gingival hypertrophy
- Soft-tissue crown lengthening
- Treatment of canker sores and herpetic and aphthous ulcers of the oral mucosa
- Vestibuloplasty

BIOLASE

EZ Lase

The EZ Lase ComfortPulse™ diode laser has a 940-nm wavelength, which was developed to absorb better and more efficiently at lower power and heat levels.



Figure 4.12 iLase™ laser. Reprinted with permission from Biolase Technology Inc.

Product specifications

- Dimensions: 3.5×7×2.5 (8.5×18×6 cm)
- Weight: 2 lbs (1 kg)
- Wavelength: 940±15 nm
- Output power: 7 W
- Power mode: CW
- Power source: 3.7 VDC, 650 mA-h or single, rechargeable li-ion battery
- 10 factory presets

iLase™

The iLase™ is a completely integrated handpiece diode laser that uses a finger switch to operate. It can be used for soft-tissue and hygiene procedures alike.

Product specifications

- Dimensions: Length: 7.2" (183 mm), with battery attached
- Diameter: 0.74" (18.7 mm)
- Weight: 0.22 lb (98 g), with battery attached
- Wavelength: 940±15 nm

TECHNOLOGY4MEDICINE

1064XLASE laser

The 1064XLASE laser is a semiconductor laser, and it is used in a variety of dental procedures, including periodontics, cosmetic, general surgery, low-level therapy, and teeth whitening. The 1064XLASE is the smallest 10-W 1064 diode laser and is easily transferred from one operatory space to another.

Product specifications

- Weight: 1.4 kg
- Wavelength: 10 nm
- Output power: 10 W
- Operation mode: CW and pulsed



Figure 4.13 1064XLASE laser. Reprinted with permission from Technology4Medicine.

- Power source: 110–230 v or lithium battery
- Touch screen

Clinical applications

- Excisional and incisional biopsies
- Exposure of unerupted teeth
- Fibroma removal
- Frenectomy
- Frenotomy
- Gingival troughing for crown impression
- Gingivectomy
- Gingivoplasty
- Gingival incision and excision
- Hemostasis and coagulation
- Implant recovery
- Incision and drainage of abscess
- Laser removal of diseased, infected, inflamed and necrosed soft tissue within the periodontal pocket
- Laser soft-tissue curettage
- Leukoplakia
- Operculectomy
- Oral papillectomies
- Pulpotomy
- Reduction of gingival hypertrophy
- Soft-tissue crown lengthening
- Sulcular debridement
- Treatment of canker sores and herpetic and aphthous ulcers of the oral mucosa
- Vestibuloplasty

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5

Periodontal therapy

Periodontal disease affects many people, and those who use lasers are beginning to understand why procedures, such as scaling and root planning (SRP), have not been effective treatments against the disease. However, the chapter first begins with a review of what periodontal disease is.

DEFINITIONS

The word *periodontal* literally means “around the tooth,” and periodontal (gum) disease is a chronic bacterial infection that affects the gums and bone supporting the teeth. This disease can affect one tooth or several teeth at the same time. It begins when the bacteria in plaque (the sticky, colorless film that constantly forms on the teeth) or biofilm, a colony-forming microorganism, causes the gums to become inflamed. Periodontal diseases, including gingivitis and periodontitis, are serious infections that left untreated can lead to tooth loss.

Approximately 75% of adults in the United States are affected by some form of periodontal disease. However, recent research conducted by the American Academy of Periodontology (Research, Science and Therapy Committee of the American Academy of Periodontology 2001) and the Centers for Disease Control and Prevention (CDC) suggest that the rates of rates may have been underestimated by as much as 50%.

Some basic facts about periodontal disease:

- It has periods of intense activity and dormancy (Raffetto 2008).
- Supragingival plaque causes gingivitis but does not cause periodontitis.
- Subgingival plaque causes periodontitis and has a large unattached component called biofilm. Once the dental papilla recedes, dental floss becomes increasingly ineffective. Toothbrushes do not reach more than 1 to 2 mm and rarely 3 mm into a pocket.
- Mouth rinses do not reach more than 1 to 2 mm into a pocket and have no effect on periodontitis. However, they can reduce gingivitis.
- Reservoir organisms recolonize the pockets are from the tongue, tonsils, and other pockets; these are called volatile sulfur compounds.

Causes and symptoms

Periodontal disease is an inflammatory disease that affects the soft and hard structures that support the teeth. In its early stage (gingivitis), the gums become swollen and red as a result of inflammation, which is the body's natural response to the presence of harmful bacteria. In the more serious form of periodontal disease (periodontitis), the gums pull away from the tooth and supporting gum tissues are destroyed. Bone can be lost, and the teeth may loosen or eventually fall out.

Periodontal disease is often silent, meaning symptoms may not appear until an advanced stage of the disease. Often, this destructive process has mild symptoms; this is unfortunate because if it was painful, then patients would request treatment. Many patients are oblivious that they may have gum disease present and may not want to listen to their dental professional. Although, periodontal disease is becoming a topic of discussion within the world now, patients are more open to hearing it when diagnosed with gum disease.

Chronic periodontitis, the most advanced form of the disease, progresses relatively slowly in most people and is typically more evident in adulthood. Although inflammation as a result of a bacterial infection is behind all forms of periodontal disease, a variety of factors can influence the severity of the disease. These factors include: stress, tobacco use, genetics/heredity, pregnancy, diabetes, medications, nutrition, systemic links, occlusion, age and lack of adequate home care. Stress can make it more difficult for the body to fight off infection, including periodontal diseases.

Recent studies have shown that tobacco use, drug and alcohol use, and the lifestyle of a person, use may be some of the most significant risk factors in the development and progression of periodontal disease. In addition, following periodontal treatment or any type of oral surgery, the chemicals in tobacco can slow down the healing process and make the treatment results less predictable. This is why many specialists may choose to refuse treatment on those individuals. With the patient who smokes, continued

tobacco use can severely compromise the success of periodontal therapy. An excellent treatment plan executed flawlessly with the latest technology does not guarantee a good result unless the patient is ready to participate completely with the clinician. Sometimes it is the human factor of a case that is the most difficult to treat.

Research shows that smokers lose more teeth than nonsmokers do. In fact, according to data from the Centers for Disease Control and Prevention, only about 20 percent of people over age 65 who have never smoked are toothless, whereas 41.3 percent of daily smokers over age 65 are toothless.

Fear of the unknown can be another factor that patients develop periodontal disease. Maybe they had previous experience that was unpleasant. Or they could be completely fearful of receiving a shot at the dentist.

Genetics can play a huge part in inheriting gum disease; studies show that they can be at risk six times more than those who do not have problems in the family history.

Hormonal changes can take its toll of a female's body; many changes will take place in a woman's body during puberty, pregnancy, and menopause that affect gum tissue.

Stress can make it more difficult for the body to fight off infection, including periodontal diseases.

Local oral factors can contribute to a patient's periodontal disease, such as, overhanging restorations, poor margins, calculus, malpositioning, and poor oral hygiene (discussed later as one of the major contributing factors).

Some patients have been neglectful toward their teeth for a variety of reason, including financial, apathy, or lack of hygiene education.

Patients with diabetes are at higher risk for developing infections, including periodontal diseases, and it takes a toll on the immune system. Systemic conditions such as diabetes and autoimmune conditions such as AIDS and Epstein-Barr virus are huge factors that can contribute to a patient's periodontal condition.

A diet low in important nutrients can compromise the body's immune system and make it harder for the body to fight off infection. Because periodontal disease is a serious infection, poor nutrition can worsen the condition of the gums.

There are hundreds of prescription and over-the-counter medications that can reduce the flow of saliva, which has a protective effect on the mouth. Without enough saliva, the mouth is vulnerable to infections such as gum disease. And some medications can cause abnormal overgrowth of the gum tissue; this can make it difficult to keep gums clean.

Severe wear on the teeth can cause premature wear and recession, allowing breakdown of the gum tissue.

And finally home care, when a person does not take proper care of their dental health, the gums do what they can to withstand the breakdown process, but after time, the bacteria will win, allowing the gums to be affected.

Pathogenesis of periodontal disease

Periodontitis begins with plaque and biofilm (Figure 5.1). The term *biofilm* is a community of bacteria enclosed within their own mucinous, gellike polymer secretions; this complex protects pathogenic bacteria from exogenous attack (i.e., antibiotics) and endogenous attack (i.e., host inflammatory response, chemotaxis, and leukocytes). Plaque is a mushroom-shaped bacterial colony, and over time, a slimy skin (i.e., exopolysaccharide) forms over the colony. As the biofilm develops, microenvironments form inside the structure; channels through the mushrooms serve as primitive alimentary canals (Gurenlian 2007). As the biofilm ages, it becomes more impregnable and resistant to antibiotics, antimicrobials, and host response. The most destructive of all periodontal pathogens are the free-floating, loosely adherent anaerobes. Mechanical destruction is the only way to eliminate a biofilm (Wilson 2001). Once a mature subgingival biofilm has developed or dental calculus is present, home care is ineffective and clinical care is required (National Institute of Dental and Craniofacial Research 2011). Within 48 hours of the dental biofilm formation, sufficient numbers of periodontopathic anaerobes are established for the onset of gingivitis (Christgau et al. 2006).

The migration of inflammatory mediators, which include polymorphonuclear leukocytes (PMNs), macrophages, cytokines, and c-reactive proteins (CRPs), into gingival sulcus causes extensive destruction of periodontal ligament (PDL), connective tissue (fibers), and alveolar bone. Destructive enzymes, such as collagenase, aid in destruction and remodeling of connective tissue. As a side note, collagenase is an enzyme that aids in

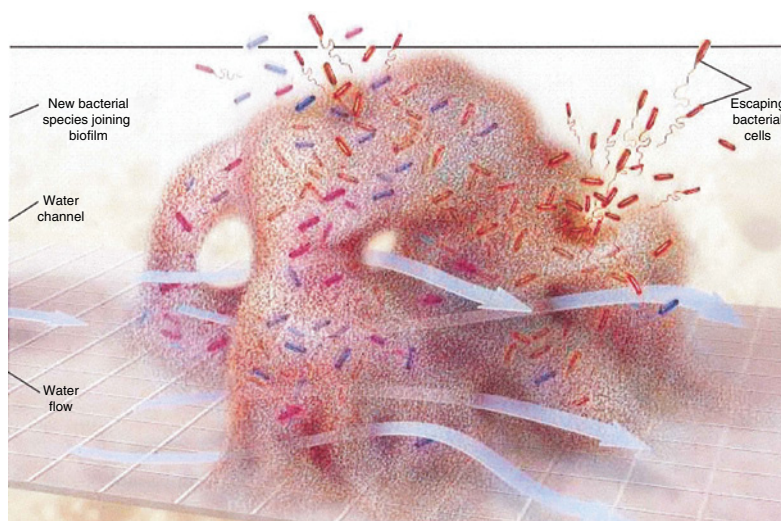


Figure 5.1 Mature biofilm. Reprinted from Costerton J. W., and P. S. Stewart. 2001. Battling biofilms. *Scientific American* 285, 74–81.

both remodeling and destroying the connective tissue. If after SRP, this local delivery antibiotic is placed too soon while still having diseased tissue present, it could destroy connective tissue as opposed to remodeling connective tissue. Collagenase is inhibited by tetracycline and because of this, placing a local delivery antibiotic right after SRP can truly affect the connective tissue, not necessarily the epithelial tissue (Coluzzi 2007). With laser periodontal therapy, the local delivery antibiotic should be placed at a particular time. Place it when all the diseased tissue has been destroyed with the laser (see Chapter 8). Continuing with the pathogenesis of periodontal disease, the permeability of the sulcular wall (volatile sulfur compounds), immune response, and Krebs cycle changes in metabolism of connective tissue and bone follow. Granulation tissue and inflammation (CRP) and sulcular bleeding are the final stages in periodontal disease (Anonymous 1999).

How many patients bleed? Most if not all! Hygienists understand this as periodontal therapists. However, hygienists and patient take the disease process for granted, often overlooking bleeding as if it is “normal” and allow patients to slide into the 6-month recare “routine cleaning” schedule. At the point that any pockets exist, the body is already responding to infection, but at a later stage in development: destructive inflammatory response. This destructive inflammatory response is underway, causing breakdown of the bone, attachment, and periodontium. With laser therapy, however, intervention occurs long before pocket formation, becoming more preventative (Mariotti 2004; Scannapieco 2004). This is one reason why hygienists need to be more aggressive in diagnosing treatment for patients.

Effects of periodontal disease

One look inside the mouth can reveal bacteria everywhere. Bad bacteria collects in gum pockets, which can cause swelling, bleeding, and bone loss and can cause teeth to loosen and fall out. More 90% of the time bad breath (halitosis) emanates from bacteria living in these gum pockets, under dentures, and on the surface of the tongue.

Bad breath is not only unpleasant to people close to you, but it may also be a clue to medical conditions, such as oral cancers, lung cancer, certain leukemias, and dry mouth syndromes, such as Sjögren syndrome. And sometimes, a systemic disease produces distinct chemical odors.

The mouth can harbor up to 500 species of bacteria, if gum disease is present. Bacteria can and will enter small blood vessels, then travel to other parts of the body and release toxins and trigger inflammatory chemicals that attack arteries and organs. This mouth-body connection has led researchers to conclude that periodontal disease has a causal relationship to variety of diseases, including heart disease, diabetes, and rheumatoid arthritis. For example, periodontal disease is caused by gram-negative bacteria, such as *Porphyromonas gingivalis*, *Bacteroides forsythias*, *Actinobacillus actinomycetemcomitans*, and *Prevotella intermedia*,



Figure 5.2 Oral inflammation. Reproduced from Miranda-Rius J., L. Brunet-Llobet, and E. Lahor-Soler. 2009. Ecstasy (3, 4-methylenedioxymethamphetamine, MDMA) related necrotizing ulcerative gingivitis. *BMJ Case Report* with permission from BMJ Publishing Group Ltd.

and the presence of *P. gingivalis* may be a risk factor for heart disease (Stein et al. 2009).

Mounting evidence continues to indicate a direct correlation between oral inflammation (Figure 5.2) and systemic diseases, such as cardiovascular disease, diabetes mellitus, lung cancer, stroke, osteoporosis, preterm low birth weight, and respiratory disease. In a patient with oral inflammation, high levels of certain inflammatory mediators are found, and these are responsible for producing CRPs. For example, high cholesterol was thought to be the major underlying cause of heart attacks; however, new research suggests that inflammation, as measured by CRP, is an even more important trigger (Scannapieco 2004).

Serum CRP is a liver protein that is increased as inflammation increases. Systemic inflammation due to chronic infection is considered a risk factor for atherosclerosis, or hardening of the arteries. Severe generalized periodontitis or even acute gingivitis results in systemic inflammation as measured by CRP levels. Treatment of these cases results in reduced CRP levels (D'Aiuto et al. 2004).

Libby (2006) offers a much more involved description of the birth of plaque and how it relates to the mouth-body connection:

1. Excess low-density lipoprotein (LDL) accumulates in artery wall, undergoing chemical changes. Modified LDLs stimulate endothelial cells to display adhesion molecules, which capture circulating monocytes (key players in inflammation) and T cells (immune cells). Endothelial cells also secrete “chemokines,” luring snared cells into the intima.
2. Monocytes mature into active macrophages in the intima; with T cells, they produce inflammatory mediators, including cytokines that carry signals between immune system cells and factors that promote cell division.

3. The macrophages display “scavenger receptors” to help ingest modified LDLs macrophages feast on them, filling with frothy, fatty droplets. These “foam cells” combine with T cells, comprising the fatty streak (early atherosclerotic plaque).
4. Inflammatory molecules trigger further plaque growth. A fibrous cap develops over the lipid core when the molecules induce smooth muscle cells to migrate to the intima surface, multiplying and producing a tough, fibrous matrix that glues cells together. The cap makes the plaque larger and walls it off from the blood.
5. Foam cells secrete inflammatory substances that weaken the cap, digesting matrix molecules and damaging smooth muscle cells that normally repair it. Foam cells may produce tissue factor, a potent clot promoter. If the plaque ruptures, a clot forms. A large clot can halt blood flow to the heart, causing a heart attack.

Because periodontopathic bacteria and destructive host responses are involved in the initiation and progression of adult periodontitis, a dual approach in the management of this chronic condition may be advisable (O’Hehir 1999).

DIAGNOSING PERIODONTAL DISEASE

To diagnose periodontal disease, periodontists rely on a visual assessment of the patient’s overall oral condition in addition to charting pocket depths with a periodontal probe. This method of assessing periodontal disease only confirms whether the disease is present. There are also several calibrated computerized tools that can assist with this data-collection process. Additionally, tests now available provide dental professionals with the detailed genetic and biological information required to better determine the appropriate treatment regimen for each individual patient. This information includes evaluating the inflammatory burden that is causing periodontal disease and looks at the patient’s unique genetic susceptibility to periodontal disease. After the data has been collected, the patient can be placed into a category by assessing which level of periodontal disease is present (Figure 5.3).

There are many forms of periodontitis: healthy, gingivitis, borderline, early, moderate, and advanced. In the healthy patient, no periodontal disease is present (Figure 5.4). The healthy patient has gingival tissue that:

- Is a shade coral or pale pink
- Has a knifelike edge adapted around the tooth
- Is stippled and firm
- Has 1- to 3-mm sulcus depth with no bleeding when probed



Figure 5.3 Gingivitis. Reprinted from Nadeem Karimbux. 2012. Clinical cases in periodontics, p. 32, with permission from Wiley-Blackwell.



Figure 5.4 "Clinically normal" or "clinically healthy" gingival tissue.

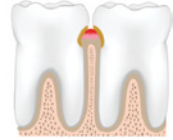
In the healthy patient, the code 01110 states that the adult prophylaxis is "performed on transitional or permanent dentition which includes scaling and polishing procedures to remove coronal plaque, calculus and stains." It is intended for use on the patient without periodontal disease.

1. NORMAL, HEALTHY GINGIVA (GUMS)

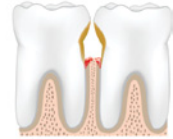
Healthy gums and bone structure hold teeth firmly in place.

**2. GINGIVITIS**

As plaque builds up, it irritates the gums along with it's by products, causing gums to feel tender, inflamed and likely to bleed.

**3. PERIODONTITIS**

Plaque hardens into calculus (tartar) if unremoved. As plaques and calculus continue to build up and irritation persist, gums begin to recede (pull away) from the teeth, forming pockets between the teeth and gums.

**4. ADVANCED PERIODONTITIS**

Left untreated, gums continue to recede farther and farther, destroying more bone and the periodontal ligament along the way. Teeth—even healthy ones—may become loose and require extraction.

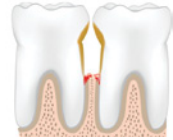


Figure 5.5 Progression to periodontal disease. Adapted from American Dental Association. 2012. *The Chairside Instructor: A Visual Guide to Case Presentations*, p. 16. Courtesy of Florence Ng.

It is unreasonable to expect that this code corresponds to the needs of most patients because only a small percentage of patients fit into this “healthy” category.

By only performing a prophylaxis when a patient comes in for a prophylaxis or asks for “just a cleaning,” hygienists are doing patients (and themselves) a disservice. Hygienists should go ahead and give patients what they ask for to make them happy customers and so that they become a repeat patient. Then a hygienist may be more able to successfully diagnose the gum disease and present the recommended treatment. If the patient declines treatment, have him or her sign an informed consent form. But at the next appointment and as rapport is established, suggest the recommended treatment again.

Gingivitis

Gingivitis (Figure 5.5) is the mildest form of periodontal disease. The bacteria in plaque and biofilm builds up, causing the gums to become inflamed (red and swollen) and often easily bleed during tooth brushing. There is usually little or no discomfort at this stage and is usually caused by inadequate oral hygiene. Although the gums may be irritated, the teeth are still firmly planted in their sockets. No irreversible bone or other tissue

damage has occurred at this stage. However, some pseudopocketing may occur; once the inflammation has been cured, these 4-mm pockets return to 3-mm pockets, allowing for healthy tissue.

The patient with gingivitis has tissues:

- Bright red or bluish color
- Bulbous, blunted, cratered or flattened papilla
- Rounded or rolled margins
- Soft and spongy tissue
- Bleeding on probing
- No pockets larger than 3 mm unless true pseudopocketing is present creating 4-mm pockets with no bone loss.

Periodontitis

However, when gingivitis is left untreated, it can advance to periodontitis. With periodontitis, the inner layer of the gum and bone pull away from the teeth and form periodontal pockets. These pockets (spaces) between teeth and gums collect debris and can become infected. The body's immune system tries to fight the bacteria as the plaque and biofilm spreads and multiplies below the gum line. When these toxins or poisons are produced by the bacteria in biofilm, the body's "good" enzymes become involved in fighting infections. The toxins stimulate a chronic inflammatory response in which the body in essence turns on itself, and the tissues, bone, and connective tissue that support the teeth are broken down and destroyed. As the disease progresses, the pockets deepen and more gum tissue and bone are destroyed. At this point, the teeth are no longer anchored in place, they become loose.

Periodontal diseases also affect one or more of the periodontal tissues, such as:

- Alveolar bone: The alveolar process is the thickened ridge of bone that contains the tooth sockets on bones that support the teeth.
- Periodontal ligament: The PDL is a group of specialized connective tissue fibers that essentially attach a tooth to the alveolar bone.
- Cementum: The cementum is a specialized calcified substance covering the root of a tooth.
- Gingiva: The gingiva consists of the mucosal tissue that lies over the alveolar bone

Borderline periodontal disease

These patients have localized periodontal disease, one to three teeth involvement in one to two areas of their mouth, and:

- Inflamed tissue (CRPs)
- Bleeding upon probing (BOP)

- 3- to 4-mm pockets on posterior teeth one to two quadrants in mouth
- Rough subgingival root surfaces
- Subgingival calculus

Early periodontal disease

These patients have:

- Inflamed tissue
- BOP
- All quadrants have 4-mm pockets on posterior teeth
- Rough subgingival root surface
- Subgingival calculus

Moderate periodontal disease

These patients have:

- Inflamed tissue
- BOP
- All quadrants have 5- to 6-mm pockets on posterior teeth sporadically
- Rough Subgingival root surfaces
- Subgingival calculus
- Beginning mobility

Advanced periodontal disease

These patients have:

- Inflamed tissue
- BOP or suppuration upon probing
- All quadrants have 7-mm pockets or greater on posterior teeth
- Rough subgingival root surfaces
- Extensive subgingival calculus
- Mobility

Other forms

Some patients have worse damage to their mouth, including aggressive periodontitis, chronic periodontitis, as a manifestation of systemic diseases, and necrotizing periodontal disease.

Aggressive periodontitis occurs in patients who are otherwise clinically healthy. Common features include rapid attachment loss and bone destruction. Chronic periodontitis results in inflammation within the

supporting tissues of the teeth, progressive attachment, and bone loss. This is the most frequently occurring form of periodontitis and is characterized by pocket formation or recession of the gingiva. It is prevalent in adults but can occur at any age. Progression of attachment loss usually occurs slowly, but periods of rapid progression can occur. Periodontitis as a manifestation of systemic diseases often begins at a young age. Systemic conditions such as heart disease, respiratory disease, and diabetes are associated with this form of periodontitis. Necrotizing periodontal disease is an infection characterized by necrosis of gingival tissues, PDL, and alveolar bone. These lesions are most commonly observed in individuals with systemic conditions such as HIV, malnutrition, and immunosuppression.

TREATMENTS

Periodontal health should be achieved in the least invasive and most cost-effective manner; this is often accomplished through nonsurgical treatment, including SRP. Periodontal scaling procedures include the elimination of plaque, calculus, and stain from the crown and root surfaces of teeth to destroy bacterial toxins followed by adjunctive therapy such as laser therapy, local delivery antimicrobials, and host modulation. Root planing is a specific treatment that destroys the roughened cementum and surface dentin that is impregnated with calculus, microorganisms, and their toxins.

These are specialized skills and when done in a timely manner can stop periodontal disease at its current stage. Elimination of adherent plaque and calculus with hand instruments and sonics or ultrasonics can also be performed on patients without periodontal disease; this is called scaling above the gum line (only 3-mm pockets deep) or more commonly called a prophylaxis. Polishing does not destroy calculus, only plaque, and should therefore only be done after all calculus has been eliminated or the calculus will get burnished onto the tooth.

Ultrasonic scalers (USSs) or sonic scalers can be used for this because their tips vibrate. Sonic scalers are typically powered by an air-driven turbine, and USSs use either magnetostrictive or piezoelectric systems to create vibration. The scalers vibrate at a frequency that breaks down bacterial cell membranes and as such, the USS eliminates a lot of both plaque and calculus. Hand instruments are used to complete the fine hand scaling that eliminates anything the USS leaves behind.

Many USSs also include a liquid output such as water, which aids in cooling the tool during use, as well as rinsing all the unwanted materials from the teeth and gum line. This lavage effect can also be used to deliver antimicrobial agents. The latest generation of USSs offers the ability to thoroughly instrument deep pockets and furcation areas and also has reports of improved operator skills, substance elimination, and more efficient and effective treatment (Christgau et al. 2006).

How many times do most clinicians destroy subgingivally blindly in a deep pocket and eliminate red, necrotic tissue without disinfecting the

pocket afterward and reevaluating it for healing? Think about the possibility of disinfecting at the beginning of each appointment by using the laser as therapy in the periodontal pocket.

Some would say that after SRP, many patients do not require any further active treatment. However, with laser use in the periodontal pocket, the standard of care has risen and results are improved beyond just SRP treatment alone. Maintenance is required four times a year, and only when periodontal health is not achieved may surgery by a periodontist be indicated to restore periodontal anatomy damaged by periodontal diseases and to facilitate oral hygiene practices.

Lasers in periodontal therapy

Initial periodontal therapy now includes nonsurgical debridement of the tooth structure, local delivery of antimicrobial agents, host modulators, and laser reduction of sulcular bacteria with laser coagulation of periodontally inflamed areas (Raffetto 2008).

Research suggests that the use of lasers as an adjunct to periodontal therapy may improve the effectiveness of this procedure. In addition, when the lasers are used properly during periodontal therapy, there can be less bleeding, swelling, and discomfort to the patient. Each laser has different wavelengths and power levels that can be used safely during specific periodontal procedures. Care should be taken to prevent damage to periodontal tissues.

In soft-tissue management procedures, the laser is being used in dental hygiene with great results. Lasers help by delivering energy in the form of light. The ability of the laser to kill bacteria in periodontal pockets and rid those pockets of sick and infected tissue has enormous potential, not only as a means of arresting the progression of periodontal disease but also as a fast and simple adjunct to the treatment dental hygienists have already been providing.

Clinical health indices were significantly improved and subgingival microflora populations, such as *P. gingivalis*, and *P. intermedia*, were greatly reduced when compared to conventional instrumentation alone. The lasers are contraindicated for calculus removal at this time. New studies have shown no negative effect on root surface damage when used with proper parameters (Coluzzi 2007).

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6

What can be achieved with lasers: possible guided-tissue regeneration

In traditional hygiene, calculus and plaque biofilm present in any diseased periodontal pockets can be destroyed as much as possible. However, the goal is to get a long junctional epithelium for healing and inactivate any pocket so the gum is no longer diseased. Additionally, maintaining any diseased pockets after inactivating the disease and halting the pocket from getting worse would be ideal. For example, some treatments mean keeping a 6-mm pocket from getting worse; getting some attachment to create a shallower pocket; or maintaining this 6-mm pocket at a 6 mm by seeing the patient after scaling and root planing (SRP) have been performed and maintaining these pockets every 3 months to prevent them from getting worse.

But what is the normal healthy state after periodontal therapy? Healthy tissue has 3-mm (or less) pockets. It is important to note that once a patient has periodontal disease that they come in at least every 3 months. Failure to continue with maintenance after therapy will allow the condition to reoccur or even worsen.

USING LASERS

Soft-tissue lasers allow an epithelial tissue turnover rate 4 to 6 days in the junctional epithelium. Connective tissue heals after therapy with fibroblasts moving into wound site; synthesis becomes significant at approximately 7 days and peaks at 3 weeks. It may continue for months until tensile strength of tissue is restored (Wilson and Kornman 1996).

Soft-Tissue Lasers in Dental Hygiene, First Edition. Jessica Blayden and Angie Mott.
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Periodontal tissue healing is a cellular race because epithelial tissue grows at 500 (0.5mm) microns/day, and osteoblasts/fibroblasts grow at 80–100 (0.08mm) microns/day. The connective tissue made up of fibroblasts accounts for 65% of the connective tissue-forming cells and osteoblasts are the bone-forming cells.

Hygienists can only destroy epithelium, not the connective tissue. This is why it is recommended to treat the sulcus by guiding the tissue back 1 mm at a time. In this way, the inflammation is stopped from the top down and the connective tissues is regenerated from the bottom up, which allows for a stronger attachment. Furthermore, the stronger attachment creates a stronger foundation for the teeth and allows for the likelihood of actual periodontal therapy maintenance as opposed to retreating the gum disease by doing traditional hygiene every year or two because the disease reactivates. The laser is now used as one of the tools to zip up any unresolved pockets during the maintenance phase after the initial therapy has taken place.

Epithelial tissue grows at a faster rate than does connective tissue. This is why it is recommended to disrupt the lateral epithelial attachment of junctional epithelium by retreating using the laser every 7 to 10 days. Please note these are guidelines for protocol when using soft tissue diode lasers, however, it is up to your office to determine the best protocol for your hygiene department.

Guided-tissue regeneration

Guided-tissue regeneration (GTR) refers to the procedures attempting to regenerate lost periodontal structures through differential tissue response. GTR alters wound healing by influencing cell proliferation and migration using fibroblasts and osteoblasts, hence receiving a stronger attachment.

The first principle evolved from periodontal wound-healing studies found that gingival epithelium migrates rapidly into most types of periodontal wounds. This forms a long junctional epithelium and prevents regeneration. Most periodontal wounds heal in this manner. This form of healing is considered a *repair* and not *regeneration* because of the original architecture and function of the periodontium is not restored (Wilson and Kornman 1996).

GTR is what the laser could accomplish with laser-assisted periodontal therapy.

Laser-assisted periodontal therapy

Laser-assisted periodontal therapy (LAPT) accomplishes these four things:

- Laser de-epithelialization (elimination of diseased tissue while leaving healthy tissue alone)
- Laser bacterial reduction (LBR)
- Biostimulation (low-level laser therapy [LLLT])
- GTR

(a)



(b)

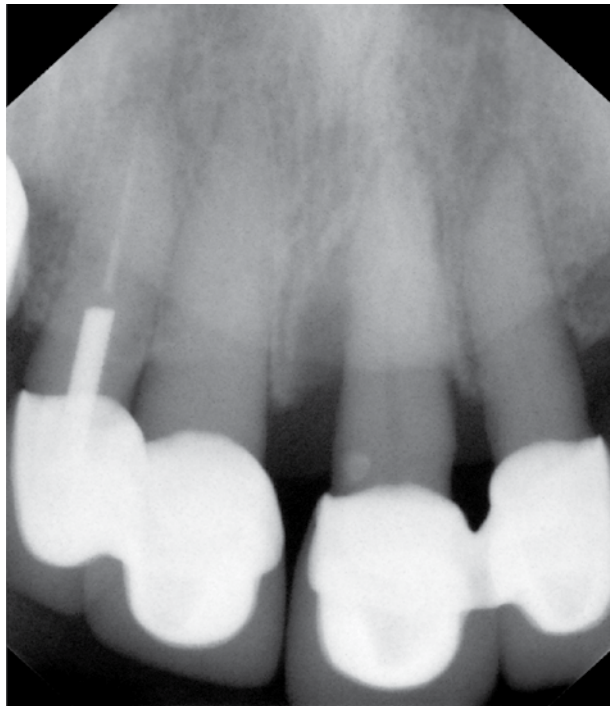


Figure 6.1 An 8-month difference. Images courtesy of Kim Cardoza.

(a)



(b)

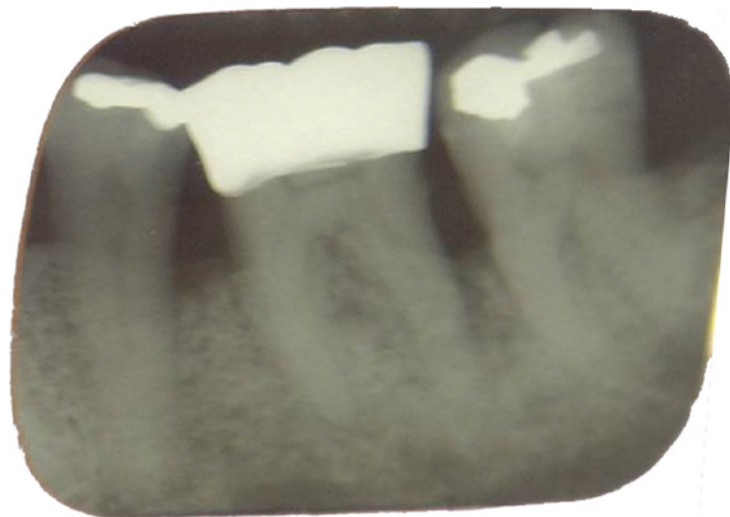


Figure 6.2 (a) Before laser therapy and (b) after laser therapy. Courtesy of Kim Stevens, RDH.

Biostimulation

Biostimulation increases four things:

- Collagen formation
- Circulation
- Osteoblastic formation
- Fibroblastic formation

(a)



(b)

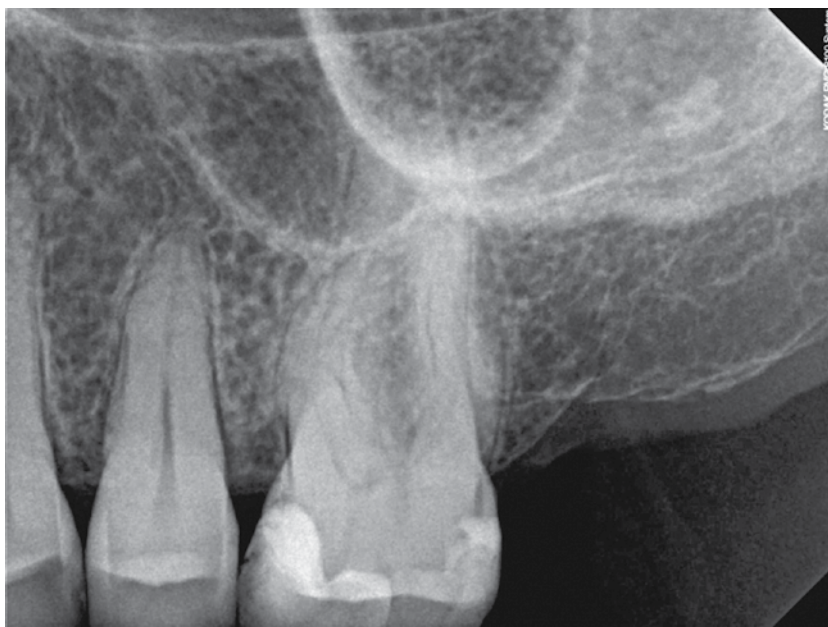


Figure 6.3 (a)–(b) 1-year difference.



Figure 6.4 Traditional X-ray, starting to see the lamina dura forming, showing the signs of healing and possible bone regrowth.

Biostimulation with a diode laser at $3\text{J}/\text{cm}^2$ can increase fibroblast proliferation six-fold. Low-intensity laser irradiation influences endothelial cell proliferation and might thereby contribute to the increase in angiogenesis and the acceleration of wound healing in vivo (Dortbudak, Haas, and Mallath-Pokorny 2000).

Other abilities that occur with the soft-tissue diode laser are the photobiological effects, which include:



Figure 6.5 Digital X-ray, starting to see the lamina dura forming, showing the signs of healing and possible bone regrowth.

- Photochemical effects
- Chemical reactions
- Chemical bonds
- Initiation of healing
- Elimination of infected or diseased sulcular epithelium and attachment from bottom up
- Biostimulation
- Pain relief
- Wound healing
- Collagen growth
- Initiates fibroblasts and osteoblasts to form and cause regrowth
- Stops the inflammatory response top down.

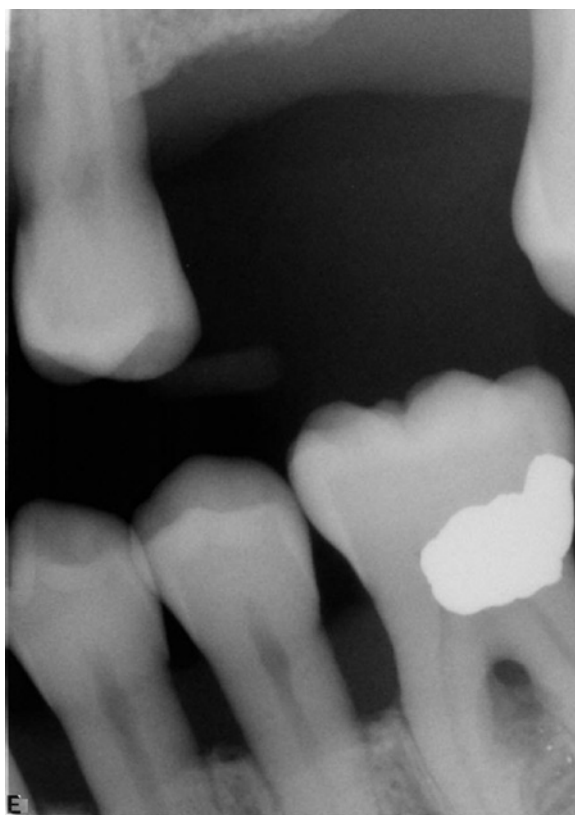


Figure 6.6 Healing process is beginning.

LASER STUDY DISCUSSION

It is vitally important to have research that proves the benefits of soft-tissue diode lasers, including biostimulation, LLLT, and regeneration of bone growth. The laser studies detailed here provide the conclusion to each study performed. Refer to the full article by using the references at the end of this chapter. The asterisk (*) indicates a new conclusion of one individual study discussed.

- Low-level lasers may provide a significant role in periodontal therapy provided by the hygienist and can be used to activate intracellular photoreceptors, triggering a cascade of events beneficial to periodontal healing (Qadri et al. 2005).*
- Average probe scores were 4.5mm for the control side and 3.8mm for the laser-treated side. Both gingivitis and plaque scores were lower for the laser-treated teeth compared to the control teeth. Gingival crevicular fluid flow and cytokine levels were also lower compared to controls (Qadri et al. 2005).*



Figure 6.7 Healing process continued.

- The diode laser reveals a bactericidal effect and helps to reduce inflammation in the periodontal pockets in addition to scaling. The diode laser therapy, in combination with scaling, supports healing of the periodontal pockets through eliminating bacteria. Various studies 15 years old highlight the same success (Moritz et al. 1998).*
- Health indices were improved and subgingival microflora populations, such as *Porphyromonas gingivalis* and *Prevotella intermedia*, were greatly reduced when compared to traditional instrumentation alone. The lasers are contraindicated for calculus destruction at this time. New studies have shown no negative effect on root surface damage when used with proper parameters (Coluzzi 2007).*
- Elimination of the diseased epithelial lining using the laser fiber is a procedure granted marketing clearance by the Food and Drug Administration for the neodymium:yttrium-aluminum-garnet (Nd:YAG) and diode lasers (Research, Science and Therapy Committee of the American Academy of Periodontology 2002).*
- Conclusion: The diode laser reveals a bactericidal effect and helps to reduce inflammation in the periodontal pockets in addition to scaling.

The diode laser therapy, in combination with scaling, supports healing of the periodontal pockets through eliminating bacteria (Moritz et al. 1998). SRP in combination with laser produces moderate clinical improvement over traditional treatment (Borrajó et al. 2004).*

- Conclusions: Diode laser-assisted periodontal curettage with SRP seems to have a superior effect than SRP or lasing alone in the clinical setting (Kamma 2003).*
- Harris et al. (2004) reviewed moderate-advanced periodontitis using conventional SRP alone and SRP combined with laser curettage. Results: Laser curettage plus SRP was more effective in treatment of periodontitis than SRP alone in improving gingival index and bleeding index and showed significant reduction in pathogens (*P. gingivalis*, *P. intermedia*) 3 months following a single treatment (American Dental Technologies 1997).*
- Three private practices conducted a retrospective study on LAPT and compared it to another study. More than 90% of all pockets of 4.0 mm and larger showed a postoperative decrease of pocket depth at 6 months. This retrospective analysis demonstrates that similar results obtained in a controlled randomized trial can be repeated in private practice with appropriate training (Harris 2004).*
- It is bacterial reduction and coagulation of diseased tissues that leaves the healthy wall of tissue for better healing against the tooth root. The root surface must still be debrided using ultrasonics and hand scalers. The laser comes in after this, turning the treatment focus toward the tissue where the disease is located. The laser is not a stand-alone therapy. "Our patients are healthier due to this innovative way of managing their periodontal disease," (Guitierrez and Smith 2006).*
- The results of this clinical application of LLLT (biostimulatory effect) revealed the fact that LLLT has the affect of bone regeneration activation as well as the high-powered effect of the Nd:YAG, which confirms that the bone regeneration effect is caused by the biostimulation of LLLT. The authors conclude for alveolar bone lesions that LLLT by the diode, argon, He-Ne, and Nd:YAG lasers have a bone regeneration effect. In addition to the clinical results, the experimental studies have certified the bone regeneration effect of LLLT (Anonymous 2009).*
- In recent years, the use of low-intensity red light in regeneration of soft tissue has been increasingly pursued. However, the effect of light of a low-dose laser directly on osteoblasts has not been investigated yet. The aim of this study was to determine the effect of continuous wave diode laser irradiation on osteoblasts derived mesenchymal cells. Three groups of 10 cultures each were irradiated three times (days 3, 5, 7) with a pulsed diode soft laser with a wavelength of 690 nm for 60 s. Another three groups of 10 cultures each were used as control groups. A newly developed method employing the fluorescent antibiotic tetracycline was used to compare bone growth on these culture substrates after

a period of 8, 12 and 16 days, respectively. It was found that all lased cultures demonstrated significantly more fluorescent bone deposits than the nonlased cultures. The difference was significant, as tested by the Turkey Test ($P < 0.0001$) in the cultures examined after 16 days. Hence it is concluded that irradiation with a pulsed diode soft laser has a biostimulating effect on osteoblasts in vitro, which might be used in osseointegration of dental implants or used for bone loss with periodontal disease. It is concluded that LLLT may increase bone repair at the early stages of healing. Low-level lasers may provide a significant role in periodontal therapy by dental hygienists (Dortbudak, Haas, and Mallath-Pokorny 2000).*

- This vivo study showed that associated therapy was suitable for non-surgical periodontal treatment. The results suggest that the diode laser may be routinely used as an adjunct to SRP without damage to the cementum (Castro et al. 2006).*
- Diode lasers (810nm) have been used in the treatment of periodontal disease as well as peri-implant therapy because of the characteristic antibacterial effects without inducing dramatic changes in the underlying tissues. The data presented in this in vitro study showed that instrumentation of the soft periodontal tissues with a diode laser; 980nm leads to complete epithelial destruction in comparison to conventional treatment methods with hand instruments in the pocket (Moritz et al. 1998).
- Diode laser (980nm) assisted periodontal curettage with SRP seems to have a superior effect than SRP or laser alone in the clinical parameters of a 12-week period of time (Kamma 2003).*
- The diode lasers reveal a bactericidal effect and help to reduce inflammation in the periodontal pockets in addition to scaling. The diode laser therapy, in combination with scaling, supports healing of the periodontal pockets through eliminating bacteria (Moritz et al. 1998).*
- More than 70% of the patients said they felt more comfortable after SRP and laser treatment than they did with SRP alone. There was a significant suppression of *Aggregatibacter actinomycetemcomitans*, an invasive bacteria often associated with the progression of periodontal disease, over the entire 6 months of the study. The diode laser at 0.8 continuous seems to be the optimal level of use and periodontal applications (Ciancio 2006).*
- Photobiomodulation has been shown to stimulate fibroblasts for faster regeneration of soft tissue, whereas providing analgesia and a modulation of the inflammatory chemicals that cause pain and discomfort. A 2006 study showed a statistically significant decrease in pocket depths at 21 and 28 days posttreatment. The laser-treated wounds presented with factors suggestive of better healing, including color, contour, and mucus healing when compared with nonlaser-treated teeth, which serve as a control. And to further exemplify these positive responses, a study by Ross and Ross (2009) demonstrated that LLLT enhanced epithelization an disproved wound healing.*

WOUND HEALING

Wound healing may be divided up into three different phases: inflammation, proliferation or regeneration, and remodeling. Numerous factors influence the entire wound-healing process, including individual tissue cells, blood circulation, and oxygenation; infection; presence of foreign bodies; patient characteristics such as age; and indulgences such as smoking and alcohol.

The effect of low-level laser irradiation on growth factors involves wound-healing events in soft and hard tissues. These growth factors can be released from the traumatized tissue, diseased tissue, and so on brought to the area by macrophages or neutrophils or harbored in a blood clot.

Growth factors may improve wound healing in numerous ways: recruiting specific cells types and stem cells to the wounded are by chemotaxis; inducing differentiation of mesenchymal precursor cells to mature secreting cells; stimulating mitosis of relevant cells and thus increasing proliferation; increasing angiogenesis (the formation of new blood vessels); and affecting secretion and breakdown of extracellular matrix components. The two major growth factors are: the fibroblast growth factor, which plays huge part in the wound-healing arena by stimulating proliferation, migration, formation of the extracellular matrix, and epithelialization, and the bone morphogenetic proteins growth factor, which in addition to the osteoblasts, helps bone formation and periodontal ligament formation.

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7

Laser applications for the dental hygienist

There are several procedures that have been approved as procedures that a dental hygienist can use in their realm of therapy with their dental hygiene license and within the state that they reside. It is vitally important that each person review the regulations, bylaws, and restrictions within their state to ensure proper use of the laser.

It is important that the hygienist takes the time to understand their respective State Practice Act (SPA). It is the responsibility of each dental hygienist. If the state allows lasers to be used in the hands of a dental hygienist, they should verify if training is needed prior to use.

The most common procedure that is routinely used by the dental hygienist is periodontal therapy. It is commonly used in addition to what has previously been called scaling and root planning (SRP). The objective of SRP, otherwise known as conventional periodontal therapy or nonsurgical periodontal therapy, is to remove or eliminate the etiologic agents that cause inflammation (i.e., dental plaque, its products, and calculus), thus helping to establish a periodontium that is free of disease.

Because in periodontal disease, pockets form that are deeper than the usual gingival depth, such SRP is often referred to as deep cleaning and may be performed using a number of dental tools, including ultrasonic instruments and hand instruments such as periodontal scalers and curettes.

Removal of adherent plaque and calculus with hand instruments can also be performed on patients without periodontal disease. This treatment would then be referred to simply as scaling. A prophylaxis refers to the polishing that is sometimes done after the SRP are complete. Polishing

does not remove calculus, only plaque, and should therefore only be done after all calculus has been removed or the calculus will get burnished onto the tooth. A curettage procedure could once also be completed; however, this is no longer an accepted procedure. It was the removal of diseased—and healthy—tissue, using a curette against the tissue. The philosophy was to “clean” the infection off of the tissue but doing so also removed important healthy tissue.

TREATMENT PROTOCOLS

This procedure is what is used for patients who suffer from gum disease. The typical procedure consists of

- Collecting data for diagnosis
- Presenting treatment plan to patient
- Scheduling according to treatment plan
- Beginning procedures

At the beginning of the first appointment, the data that has been collected is used to determine what areas should be looked at to begin the treatment plan. After the information has been collected and analyzed, the information is presented to the patient, and if treatment plan is accepted, then scheduling should be done and the procedure started.

To begin with, ultrasonic scalers (USSs) or hand instrumentation should be used to remove all the toxins off of the surfaces of the hard tooth structure. Once this procedure has been completed, the process of using the laser begins.

The pockets are measured to determine their depth. Depending on the training provided, the hygienist determines where the laser needs to be used. From here, the laser is placed into the pocket, with care given to make sure the tip is directed toward the tissue and not to the tooth. Once placement is achieved, immediately begin moving the laser as tissue interaction will begin when the foot pedal is depressed. Always start the laser when the laser is in the sulcus, and never sit and hold the laser on the tooth. Use the lowest power necessary to achieve the greatest results. The goal for this procedure is to eliminate all of the diseased, infected tissue inside the pockets.

Another application of the laser in the hands of a dental hygienist is to treat herpetic lesions (fever blisters). This in one of the biggest practice builders a soft-tissue laser can be used for. The laser will immediately help relieve the throbbing sensation associated with these lesions. Typically, the lesions will be arrested in as little one to two appointments and is completed without even touching the lesion. The laser tip is used in noncontact mode with an uninitiated tip. Several passes over the lesion at various settings will allow the lesion to obtain the full effect that the laser can provide.

Another procedure that the laser can provide is the ability to eliminate aphthous ulcers (canker sores), which are treated similarly to the way that herpetic lesions are. Desensitization is another procedure that uses the non-contract method. This method allows the sensitive areas to obtain the full effect the laser can provide.

There are a few other procedures that are not an accepted procedure for most states. These include using the laser in a noncontract mode to alleviate a bluish, purple lesion on patient's lips. These lesions can be caused from trauma and sunshine.

Each of these applications will be discussed in more detail in the next chapter as well as how to implement them into a hygiene program and how to use them as a new standard treatment plan for patients.

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8

How to implement lasers in dental hygiene

In this chapter, procedures that can be applied and implemented by the dental hygienist will be discussed. Again, it is the responsibility of the hygienist to ensure which laser applications can legally be performed within the state.

Most patients come in for a cleaning twice a year because their insurance covers it, and they believe they are doing a preventative procedure. However, if bleeding is present in patients' mouths, then hygienists know that the patient is past the point of prevention. It is vitally important that patients are educated about the signs of gum disease and that the diagnoses made are more aggressive or that hygienists insist on recare. Hygienists can fall into the trap of allowing insurance companies to dictate the amount of care for patients. It is imperative that hygienists examine patients and create a treatment plan that suits their dental needs. In this chapter, laser bacterial reduction (LBR), laser-assisted periodontal therapy (LAPT; de-epilialization of the diseased tissue), herpetic lesion, aphthous ulcer (canker sore), and desensitization of the tooth structure will be discussed.

LASER BACTERIAL REDUCTION

This procedure is used for every patient that comes for a hygiene appointment in the office. Whether they have perfectly healthy gingiva, gingivitis, or periodontal disease, this procedure is beneficial to patients because of the added benefit it can provide.

PATIENT INTRODUCTION TO LASER BACTERIAL REDUCTION

We are constantly learning and striving to advance the standard of patient care in our office. As such, we have recently added a new procedure to your professional teeth cleaning to help fight periodontal (gum) disease.

Periodontal disease affects approximately 80% of adults and is a growing epidemic in our society. Understanding of this disease has increased greatly over the last few years, and we now know that periodontal disease is a bacterial infection in the gum tissues around teeth. We now not only treat periodontal/gum disease with removal of mechanical irritants and diseased tissue (your normal cleanings) but are also addressing the underlying infection that causes it. With that thought in mind, we recommend that all of our patients have their teeth and gums decontaminated with a diode laser during their cleaning appointments for three major reasons.

1. **To reduce or eliminate bacteremia.** During the professional teeth cleaning process most patients will have some areas that may bleed. This allows bacteria (pathogens) that are present in all of our mouths to flood into the bloodstream and sometimes settle in weakened areas of our body such as a damaged heart valve or artificial knee, hip, etc. We typically premedicate those patients that we know have a heart condition or artificial joints with antibiotics so that these bacteria cannot cause harm to these areas. Latest research shows that these oral pathogens have now been linked to a number of other diseases such as cardiovascular disease, rheumatoid arthritis, low birth weight babies, and diabetes. Needless to say, anything that we can do to reduce or eliminate bacteremia is positive for all our patients.
2. **To prevent cross contamination** of infections in one area of your mouth to other areas. Decontamination minimizes the chance that we may inadvertently pick up bacterial infection in one area of our mouth and move it to another.
3. **To kill periodontal disease bacteria** and stop the infection before they cause physical destruction or loss of bony support around your teeth.

The laser decontamination process is painless and normally takes about 5-10 minutes. We highly recommend that you take advantage of this service as part of your teeth cleaning.

Laser decontamination, when combined with the cleaning, is an additional \$35. Unfortunately this treatment is not covered by most insurance plans. Insurance companies and the coverage they provide are almost always behind the leading edge in state-of-the-art health care.

Please ask our hygienist, Jessica, or any of our educated team members, if you have any questions regarding this treatment.

Figure 8.1 Laser bacterial reduction introduction to the patient. This is used in the patient's periodontal treatment folder. Courtesy of Jessica Blayden.

It is even recommended for pediatric patients starting at the age of 8; this is when mixed dentition is present and when children are in orthodontia. Many times orthodontia produces inflammation, redness, poor oral hygiene, and moderate to severe bleeding resulting in gingivitis. This is the ideal use for LBR for these patients, in addition to usual hygiene service.

Each patient can benefit from this procedure because everyone has bacteria present. In addition, as described in Chapter 5, bleeding is the last stage of the pathogenesis of periodontal disease, and most, if not all, patients bleed.

LBR should be performed on every patient for these added benefits (Figure 8.1):

1. to reduce or eliminate bacteria from the mouth
2. to prevent cross contamination
3. to prevent periodontal pathogens before loss of attachment

A typical setting for the LBR (Figure 8.2) is:

- Power 1.5 W
- Pulse duration 20 ms/s
- Interval 20 ms/s
- Uninitiated tip
- 10 to 15 seconds per tooth

The laser is used on 1.5 W pulsed (pulsed meaning it is on half the time and off half the time), creating a thermal relaxation period so the patient's gingiva is more comfortable. This means 0.75 W is being emitted to the tissues and allowed to be absorbed. The laser is placed 0.5 mm into the sulcus and used with an uninitiated tip. An initiated tip is when articulating paper (e.g., Acufilm 2, Plastic is best) is melted on the end of the laser fiber to become pigmented to absorb/attract the diseased/infected tissue while leaving the healthy tissue alone. With an uninitiated tip, the laser fiber is bare (flashlight effect in the sulcus) and without pigment on the end of the fiber.

This procedure is used in an exploratory stroke with a light feather grasp, not a working stroke, taken around each tooth in the sulcus allowing the laser energy to be in a defocused mode because it is uninitiated like a flashlight effect in the pocket. Use the laser for 10 to 15 seconds per tooth, both buccal and lingual, while focusing the laser toward the tissue not the tooth.

There is the possibility that the laser may initiate itself during this procedure. The tell-tale signs are smoke, plume, patient response, and the laser fiber may start coagulating tissue. When diseased tissue is present, even with the laser being placed at 0.55 mm, the laser naturally initiates if bleeding occurs, inflammation is present, or sometimes

plaque is present. If this happens, take the cleaving instrument provided by the laser manufacturer and cleave (score lightly) the laser fiber to become a bare freshly cleaved round circle so no spurring occurs and to ensure you are in the correct mode.

LBR lowers the gram-negative bacteria specifically from billions 10^9 down to hundreds 10^2 and lasts for 4 to 6 weeks (Moritz et al. 1998). Doing a LBR first on every patient that comes in for a cleaning eliminates bacteria, prevents cross contamination, and prevents periodontal pathogens before loss of attachment. Further, it reduces patient sickness after cleaning (as a result of free-flowing bacteria) and it helps prevent hygienists from being exposed to the same bacteria.

After LBR, the hygienist may consider polishing as another step in reducing bacterial plaque, which also cuts down on the time of scaling and allows the hygienist to focus on calculus.

The cost for this procedure is generally \$25 to \$40 for the full mouth and most insurance does *not* cover it. However, if dental hygienists were to implement LBR on *every* patient, it would increase revenue:

5 patients $\times$ \$35 = \$175 a day increase

$\times$ 4 days: \$700 a week increase

$\times$ 4 weeks/1 month: \$2800 a month increase

$\times$ 12 months: \$33,600 a year increase.



Figure 8.2 Laser set at 1.5 W, pulsed, for laser bacterial reduction.

LASER-ASSISTED PERIODONTAL THERAPY

As a basic premise, the gold standard for successful treatment is defined as maintenance of, or gain in, the clinical attachment level, and initial therapy has a similar widely accepted benchmark in that treatment must include debridement of the accretions on the root surface by means of scaling. These are the settings for laser-assisted periodontal therapy (LAPT; Figure 8.3):

- Power 0.5–1.0 watts
- Continuous wave
- No pulse or interval
- Initiated tip
- 10 to 15 seconds per pocket but no more than 1 minute per tooth
- Nd:YAG 1064-nm settings are as follows: 30 mj, 50 Hz = 1.5 W, 40 s a site, adjust as needed.

To begin LAPT, go over the probe sheet and select a treatment plan. Always start with the deepest pockets because these areas will be retreated with the laser at subsequent appointments. If pockets are more than 7 mm in a particular area, the hygienist may only want to treat two to three teeth a session (not quadrants). Each session is determined by individualizing the treatment plan, and the hygienist dictates that by answering the following questions:



Figure 8.3 Laser settings for laser de-epithelization.

- How much bleeding is present?
- What are the systemic factors/environmental factors?
- How deep are the pockets?
- Is there mobility or suppuration present?
- How much calculus is present?
- How much plaque is present?
- How cooperative is the patient?

The goal, as a hygienist, is to reduce the pocket depth below 4mm. At each subsequent session, relase the previous pockets from the last sessions. Rescaling is not necessary once the calculus is removed; use the cavitron prior to, and after, relasing to remove the biofilm that redevelops in 7 to 10 days. Repeated treatments are necessary to achieve a positive laser effect in clinical applications.

Treatment planning formulas

Deepest pocket minus 3 and that is equal to the total minimum amount of sessions needed

OR

If any two quadrants are the same pocket depth, take the deepest pocket in each quadrant added together and divide by 4 and that equals the minimum amount of sessions needed.

When setting up the treatment plan, take into consideration the individual and how much time (sessions) may be needed to complete the work. You may want to add a session to ensure thorough treatment is allotted.

Scheduling

Figure 8.4 is an outline for those who need active periodontal therapy.

Initial periodontal therapy appointment

- Schedule sessions for periodontal therapy approximately every 7 to 10 days (evaluate occlusion during periodontal therapy)
- When done with all LAPT sessions, set up a 6-week follow-up
- Then set up a second 6-week follow-up after the first

It is important to classify patients first and diagnose what level of periodontal disease is present. An early periodontal disease case will be used as an example to illustrate how to implement the laser into current hygiene therapies.

During periodontal charting and examination, the patient will have bleeding gums, infection, and gum pockets with depths of 4mm or more.

Anything more than 3 mm with bleeding is a diseased condition. Pockets are where bone loss or gum infection is present. This infection leads to bad breath, bad taste, bleeding, tender gums, and eventual tooth loss.

The following *nonsurgical* treatment program is recommended to treat the patient. Initial periodontal therapy (IPT) is for new patients or those that have not been seen for 1 year. These patients should have come in at least twice in the last year and maybe more if their recare was every 3 to 4 months; however because they did not, it is time to reassess their periodontal condition. If a prophylaxis is still needed, perform this procedure and then place on the patient on a 3-, 4-, or 6-month recare program. If active periodontal disease is present, codiagnose and develop a treatment plan using the laser. Then present this plan to the patient before discussing the etiology of periodontal disease and introducing the soft-tissue diode laser.

The discussion should highlight the following information:

- The use of LBR first and why and laser decontamination using a 1.5 pulsed, noninitiated tip (NIT)
- Disclose the patient
- Use ultrasonic scaler (USS) for a full-mouth debride
- Possible use of LBR using 1.5 pulsed-NIT after debride because the amount of calculus present
- Go over home care instructions and introduce home care medicaments and aids (Figure 8.5), including, but not limited to, electric toothbrush, water pick, and floss. Also patient may use chlorhexidine (dip brush and brush teeth) or use a mouth rinse and have patient dip toothbrush into mouth rinse and brush gingiva. This stimulates the gingiva and allows the mouth rinse to focus on any inflammation that may be present.
- Encourage patients to set goals and strategies for long-term implementation into lifestyle

Classic periodontal therapy appointment

It is important to review the steps in the subsequent periodontal therapy appointments.

- Review health history, blood pressure, and chief complaint
- Anesthesia/topical (for those states in which anesthesia can not be given) in any areas doing scaling and root planing (SRP) and laser.
- Begin with LBR (use the specific laser eyewear). Place laser at 1.5 W pulsed with an uninitiated tip. Spending 10 to 15 seconds per tooth including both buccal and lingual. Place laser fiber 0.5 mm in the sulcus.
- Use of USS or hand instruments to perform SRP.

HOME CARE INSTUCTIONS
Morning: 1. Electric tooth brush/Manual tooth brush: 2 minutes. Each technique is different depending on the type of electric toothbrush you have. Use the technique demonstrated to you from your hygienist. Brushing with Flouridex toothpaste (remember spit the excess out and do not rinse or eat/drink for 30 minutes) 2. Floss/Rotapiks: Ensuring that you are curving the floss in a "C" shape manner. Piks: flat part toward the gums. 3. Chlorhexidine: Brush and dip using an end-tuft brush. Place a small amount of the mouthrinse in cup and dip the end-tuft into the chlorhexidine bringing the brush in between each tooth toward the gums, do 3–5 seconds then repeat. 4. OTHER: _____ Evening: 1. Electric tooth brush/Manual tooth brush: 2 minutes. Each technique is different depending on the type of electric toothbrush you have. Use the technique demonstrated to you from your hygienist. Brushing with Flouridex toothpaste (remember spit the excess out and do not rinse or eat/drink for 30 minutes) 2. Floss/Rotapiks: Ensuring that you are curving the floss in a "C" shape manner. Piks: flat part towards the gums. 3. OTHER: _____

Figure 8.5 Example of the home care instruction sheet given to the patient to take home. This is used in the patient periodontal treatment folder. Courtesy of Jessica Blayden.

- LAPT begins (Figures 8.6 and 8.7). Place settings at 0.5–1.0W, continuous wave on pocketing 4mm and higher. Use initiated tip if doing gingival curettage (state allowing), and if not, use an uninitiated tip.
- Calibrate (Figure 8.8) fiber with the periodontal probe less than 1 mm in the initial pocket depth and retreat any previously treated pocket. For example: If the pocket is a 7mm, then calibrate fiber to 6mm, and if a 7-mm pocket is being retreated for the second time, the fiber about be calibrated at 5mm. Treating in this way allows the connective tissue to catch up with the epithelial tissue and leading guided-tissue regeneration.
- Hold laser handle with light feather grip.
- Use soft-tissue fulcrum.
- Insert the fiber in the sulcus, keeping it parallel and slightly angled toward the disease epithelium.
- Start on the crest and working down to the base of the pocket.
- Move the fiber in overlapping horizontal, then a diagonal direction with fast painting strokes.



Figure 8.6 Process using laser from the crest of the pocket moving down to the base of the pocket in a horizontal/diagonal direction toward the tissue continuously moving the laser fiber.



Figure 8.7 Initiated tip with diseased coagulated tissue from the infected periodontal pocket.

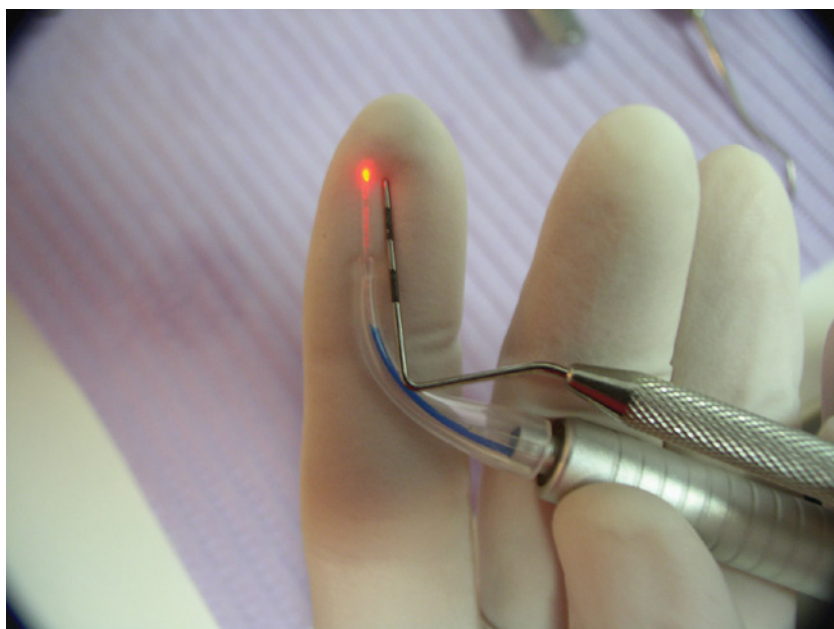


Figure 8.8 Calibrating the fiber tip with the periodontal probe to the length of the pocket, <1 mm.



Figure 8.9 A #11 mesial facial 8-mm pocket.



Figure 8.10 Laser in pocket at 7 mm.



Figure 8.11 Fresh bleed postoperatively.



Figure 8.12 Vitamin E capsules: break capsule and apply to open wound area. It is used with the laser to enhance healing. Photo courtesy of photos-public-domain.com

- Use 1 minute per tooth and 10 to 15 seconds per pocket or until a fresh bleed is present; this indicates that the laser use for each wound site is complete. Intermittently wipe with a wet 2×2 gauze strip with water to remove coagulated diseased tissue.
- Use USS to remove any dead necrotic tissue and lavage any area treated with the laser.
- Complete LBR (using specific laser eyewear). Place laser at 1.5W pulsed. Measure the periodontal pocket and use an uninitiated tip. Do this for 15 to 20 seconds per tooth, including both buccal and lingual. It is important to note that biostimulation occurs during this step more than any other step because all the irritants, calculus, plaque, and diseased tissue have been removed.
- Irrigate with preferred irritant but not chlorhexidine (CHX) gluconate because it inhibits fibroblasts and osteoblasts. Betadine iodine, full strength, is an effective irrigant. Studies showed that full-mouth debridement with and without adjunctive antimicrobials or quadrant therapy improved clinical outcomes. Repeated oral hygiene instructions and thorough instrumentation with the power scaler overshadowed any benefit from adding CHX to the power scaler lavage.
- Place chemotherapeutic agent (i.e., local delivery antibiotic) in those areas less than 5mm that have been retreated with the laser, and in theory, where the pocket depth is 3mm.
- Place vitamin E (Figure 8.12) on all lased areas to help promote healing.

- Give postoperative instructions and review hygiene instruction.
- Set up next session or definitive therapy 6 weeks following periodontal therapy sessions.

Definitive therapy

This therapy should be done 6 weeks after the periodontal therapy sessions. These steps should be used in the 1-hour definitive therapy (DT) appointment.

LBR is started at 1.5W pulsed, with specific eyewear placed, and spending 10 to 15 seconds per tooth, including both buccal and lingual. Place tip 0.5mm in sulcus, review hygiene instruction, and gently clean teeth, removing any reintroduced plaque or calculus and retreating any bleeding or inflamed areas with the laser. The fiber should be calibrated and pockets 3mm or more should be treated using LAPT. In addition, make sure all the calculus is removed as well; when bleeding is present after therapy, it usually indicates that calculus is still present. Then schedule supportive periodontal therapy 6 weeks after this appointment, making it 3 months after periodontal therapy.

Supportive periodontal therapy

During this appointment evaluate and probe and do supportive periodontal therapy (SPT). Celebrate any positive results, and retreat any unresolved pockets. Reimplement laser therapy as needed or set up 3-month recare. If the patient presents with unresolved pockets, use the laser to zip up that pocket by retreating the pocket.

This new standard of care may make it necessary for patients to initially come in for a SPT visit four times a year. However, it is important to stress to the patient that periodontal health needs to be maintained because it can not be cured.

POSTOPERATIVE INSTRUCTIONS

Figure 8.13 illustrates postoperative instructions to give to the patient after treatment.

Give the patient any recommendation you would normally give them after traditional periodontal therapy, but specific to the laser:

- No smoking for 48 hours.
- No flossing or use of any interdental aid for 3 days.
- No water pick use during periodontal therapy.
- Do not brush that evening; start next morning however, be gentle.

Postoperative Instructions

Care of your mouth: Rinse with warm a salt-water rinse (1 teaspoon of salt mixed with 8 oz. warm water). Start home care as instructed when tissue starts to feel comfortable. No flossing for 3 days after treatment and if any antibiotic was placed wait 10 days after placement. Do not brush the evening that treatment was received. Resume the next morning. Initially, you may have to be very gentle with your home care. Absolutely no use of water pick during gum therapy.

Discomfort: Before the procedure, you may have been given anesthetic to ensure your comfort. This anesthetic typically leaves your lips, teeth, and tongue feeling numb after the appointment. For this reason, you should avoid chewing for 2 hours following the procedure, or until the numbness has completely worn off. Some discomfort after the treatment is normal. Ibuprofen or Tylenol is usually sufficient to help with any discomfort.

Eating: Your next meal should consist of soft foods. Avoid any hard foods like potato chips, popcorn, etc. for the next 3-4 days to not disturb any healing taking place.

Swelling: Swelling or jaw stiffness rarely occurs, however if it does, place warm moist towels to the face in the area of any stiffness.

Smoking: Do not smoke following gum therapy procedures. Tobacco smoke is an irritant to any healing. Refrain from smoking at least 48 hours after treatment was received. If you have thought about quitting, this would be a great time! We can help you.

Your Hygienist,
Jessica Blayden RDH

Figure 8.13 Example of postoperative instructions. It is used in the patient periodontal treatment folder. Courtesy of Jessica Blayden.

Desensitization, herpetic lesion, and aphthous ulcers

The treatment for these three applications is the same.

- Use uninitiated tip at 1.5 W pulsed
- Start 5 mm away from root surface, bathing the area with tip. Use low, small circular motion and keep tip moving as you move closer to root surface (do not actually touch root surface).
- Back off and proceed again from 5 mm away working toward surface.
- Once ready keep 1 mm away from the lesion and maintain the laser in a defocused, noncontract, continuous mode for a total of 90 seconds.
- This process may be repeated with one setting at 1.7 W pulsed for 90 seconds and 2.0 W pulsed for 90 seconds, especially if the patient feels any sensations such as pain or tingling.
- If the lesion is too big, then consider breaking the lesions into three or four different ones and treating them separately.
- Using the Nd:YAG, however, you can use the laser in the following manner for desensitization, herpetic lesion, and aphthous ulcers.
 - Noncontact, NIT, continuous wave: Place laser 2 mm away from lesion. High-volume evacuation is mandatory, start at a low setting, 0.3 mw and increase by 0.2 mw every 45 to 60 seconds up to 5 settings (i.e., 0.3 mw, 0.5 mw, 0.7 mw, 0.9 mw, and 1.0 W) finishing procedure by placing vitamin E on areas.

In desensitization, it is thought that the laser pulls dentinal fluid toward pulp chamber and possibly “crimps” the tubules, thus disallowing factors that influence sensitivity, but this is not proven. Other thoughts have been that it desiccates the fluid in the tubule and the fluid stops sloshing back up and forth and obstructs the tubules somehow. The hygienist should be able to use his or her explorer right after doing this procedure to ensure it was successful. This procedure works for most, but not all, sensitivity issues, but it only diminishes it and does not cure it (Sicilia et al. 2009; Ross and Ross 2008).

In herpetic lesions (Figures 8.14–8.17), the laser kills the virus and sends it back to the subganglion. Make sure to use high-volume evacuation and a high-filtration mask when treating herpetic lesions.

Aphthous ulcers (canker sores) are an autoimmune disorder, and the laser kills the bacteria associated with it. The lesions heal immediately, turning white and drying up while using the laser.

For all of these uses, the laser is best used in the prodromal stages. These are the five most common applications used with the soft-tissue diode laser for the dental hygienist. To view these laser applications for the hygienist in a DVD format please visit www.periolaserinstitute.com.



Figure 8.14 Day 1 after a laser treatment for herpetic lesion.



Figure 8.15 Day 2 after a laser treatment for herpetic lesion.



Figure 8.16 Day 7 after a laser treatment for herpetic lesion.



Figure 8.17 Postoperative laser treatment for herpetic lesion.

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9

Communication skills for the dental hygienist

Why is communication important to a dental hygienist? After all, the interaction with patients is limited because they can not talk while their mouth is being cleaned.

Actually, communication is the key to success, especially when it comes to explaining treatment plans to patients and allowing them the opportunity to ask questions as well.

To ensure the best communication, it is best that the patient is sitting upright and that all protective gear (e.g., mask, gloves, and safety glasses) are removed. It is important to build a rapport with patients because people buy from those they like and trust (Bacon 1999). Aim to learn something new about each patient every visit—write it down if necessary—and use this one piece of information to build a relationship with the patient that is based on something other than teeth.

Let's review a few facts about communication. Nonverbal communication accounts for 65 to 70% of communication between people (Bacon 1999). Follow the patient's nonverbal cues to determine if he or she needs more than just a few minutes' explanation of procedures and treatment plans. Remember to treat each person as an individual with their own history in regard to taking care of their teeth and what currently brought them into the office.

Avoid power struggles with patients. A hygienist can repeatedly tell a patient that he or she has gum disease, but until the patient is ready to hear it, it will not sink in. The key is to be a broken record, repeating the same information, as it applies, to the patient. The patient will, in their own time, understand.

THE 7 Cs OF COMMUNICATION

There are a few points to consider when it comes to communicating; let's review the 7 Cs of Communication.

Clear

When writing or speaking to someone, be clear about your goal or message. What is your purpose in communicating with this person? If you are not sure, then your patient will not be sure either.

Minimize the number of ideas in each sentence. Make sure that it is easy for the patient to understand the meaning of what is being said. People should not have to "read between the lines" and make assumptions on their own to understand what you are trying to say.

Concise

Stick to the point and keep it brief. The patient does not want to hear 10 minutes of information when the message can be communicated in 3 minutes.

Concrete

A concrete message includes details (not too many) and vivid facts so that the patient has a clear picture of what he or she is being told.

Correct

Correct communication is appropriate and error-free communication.

Coherent

Coherent communication is logical. Further, all points are connected and relevant to the main topic, and the tone and flow of the text are consistent.

Complete

Complete communication is providing the patient with everything needed to be informed, and if applicable, make a decision.

Courteous

Courteous communication is friendly, open, and honest. The patient's viewpoint is always in mind, and communication is empathetic to his or her needs.

There are a few variations of the 7 Cs of communication, as well.

Credible

Is the communication credible? Does your message improve or highlight your credibility?

Creative

Does your message communicate creatively? Creative communication helps keep the patient engaged is what is being said.

We communicate every day, and the better we communicate, our credibility will extend to clients, bosses, and colleagues.

QUESTIONS TO ASK

Asking the right question is at the heart of effective communications and information exchange. By using the right questions in a particular situation, a whole range of communications skills can be improved.

Open and closed questions

A closed question usually receives a single word or a short, factual answer.

For example, "Are you thirsty?" The answer is "Yes" or "No"; "Where do you live?" The answer is generally the name of your town or your address.

Open questions elicit longer answers. They usually begin with what, why, or how. An open question asks the respondent for his or her knowledge, opinion, or feelings.

"Tell me" and "describe" can also be used in the same way as open questions. Here are some examples:

- What happened at the meeting?
- Why did he react that way?
- How was the party?
- Tell me what happened next.
- Describe the circumstances in more detail.

Open questions are good for:

- Developing an open conversation
- Finding out more detail
- Finding out the other person's opinion or issues

Closed questions are good for:

- Testing your or the other person's understanding
- Concluding a discussion or making a decision

A misplaced closed question, on the other hand, can kill the conversation and lead to awkward silences.

Funnel questions

This technique involves starting with general questions, homing in on a point in each answer, and asking more and more detail at each level. It is often used by detectives taking a statement from a witness.

Probing questions

Asking probing questions is another strategy for finding out more detail. Sometimes it is as simple as asking for an example to help your understanding. At other times, additional information is needed for clarification or to investigate whether there is proof for what has been said.

An effective way of probing is to use the Five Whys method, which can help quickly get to the root of a problem.

Leading questions

Leading questions try to lead the respondent to a certain way of thinking. They can do this in several ways:

- Phrasing the question so that the “easiest” response is “yes.”
- Giving people a choice between two options, both of which you would be happy with, rather than the choice of one option or not doing anything at all.

Rhetorical questions

Rhetorical questions are not really questions at all, in that they do not expect an answer. They are statements phrased in question form.

Questions are a powerful way of:

- Learning
- Managing and coaching
- Avoiding misunderstandings
- Defusing a heated situation
- Persuading people

LISTENING

The most important part of communication is listening. When engaged in communication, make sure that you give the person you are talking with enough time to respond. This may need to include thinking time

before they answer, so do not interpret a pause as a “no comment” and plow on.

Skillful questioning needs to be matched by careful listening so that it is understood what people are saying when they answer. When the other person is talking, our “transmitter” must be off and our “receiver” on.

When all of this information is taken into consideration, patients will feel more comfortable with talking to you and be able to ask questions when they do not understand.

STYLES OF COMMUNICATION

If you can get a feel on how to recognize a person’s style of communicating, it is best to communicate with their own style.

Extraverts

- Like variety and action
- Like to have people around
- Can be enthusiastic communicators
- Often think out loud
- Want to discuss topics before committing anything on paper
- Enjoy work that involves interacting with others
- Are typically action oriented; uncomfortable with lengthy discussions

Introverts

- Prefer quiet and time for concentration
- Are often drained by continuous interaction with others
- Like working alone
- Often prefer to write out ideas before discussing them
- May be reluctant to socialize
- Are more difficult to engage in sustained conversation
- Are often disturbed by interruptions

Sensors

- Are practical and down to earth
- Are factual and are usually good detailers; they are concerned about the specifics
- Are concerned about what works and what has been proven; are suspicious of the abstract
- Are more comfortable fine-tuning something that already exists rather than trying something totally new
- Want to reduce risk

- Want to be shown why something makes sense; need proof before becoming comfortable
- Are typically more interested in applications than theory
- Want to understand the details for each step before moving on

Intuitors

- Are oriented toward the future and possibilities
- May disregard facts or even make factual errors
- Prefer the big picture; need a road map first
- Are typically more interested in theory than applications
- Enjoy learning new skills
- May seem restless and often work in bursts of energy
- Are visionary and follow their inspirations, may not be able to explain their rationale.

Thinkers

- Are analytical and objective
- Tend to make impersonal decisions; may not consider the impact on people
- Focus on the principles behind the decision or plan
- Tend to be firm minded and may be critical
- Appreciate a well-organized presentation with point that are well supported
- May seem insensitive to others

Feelers

- Are concerned about how decisions affect people
- May allow decisions to be influenced by what people like or dislike
- May have trouble delivering bad news to others
- Are often appreciative and personable
- May appear to be illogical or to value harmony over logical conclusions
- Will generally come across as being open and forthright
- Are often empathic and good listeners

Judgers

- Want closure; want to get things settled and finished
- Are typically decisive, sometimes to a fault, making decisions too quickly
- May become impatient with lengthy discussions that appear to be going nowhere
- Want to see things structured and scheduled

- Are often good time managers and may insist that others be as punctual and controlled
- Dislike surprises
- Tend to be organized and to focus on the tasks to be done
- Make and use “to do” lists

Perceivers

- Are typically uncomfortable with tight deadlines
- Are flexible and adaptable
- Prefer to leave things open and expect last-minute changes
- Are open to exploring new approaches and alternative to what has already been chosen
- Focus more on process than results
- May postpone decisions to gather more information or search for more options
- Are often uncomfortable with time management or feel guilty that they do not manage time as well as judges seem to
- Are usually spontaneous and will do things at the spur of the moment.

Patients are a combination of these types of communicators, and these categories can be used as a guide when dealing with patients. Table 9.1 focuses on repairing yesterday, which allows for guilt, or focusing on preparing today and impacting tomorrow, which instills hope. It is important for the patient’s well-being and a hygienist’s practice to not allow yourself to get stuck and caught up in a one-sided conversation for patient compliance (McManus and Duvall, 2006).

Table 9.1 Excellent vision and communication for our patients.

Repairing focus is on yesterday: GUILT	Preparing focus is on today and impact for tomorrow: HOPE
Consumes time	Increases efficiency
Fosters discouragement	Increases confidence
Increases cost	Saves money through prevention
Pays now for yesterday	Pays now for tomorrow
Becomes an obstacle to growth	Takes you to a higher level
Focuses on calculus removal	Focuses on comprehensive care
Takes more appointment time	Opens opportunities within the appointment
Decreases service mix	Increases variety of services
Uses hand instruments	Makes use of ultrasonic and laser technology
Patient remains in danger zone	Patient remains in safety zone

McManus, V., and C. Duvall. Prepare for a fabulous career. *Academy of Cosmetic Dentistry*, Summer Volume 22(2): 36–39. Used with permission.

PRINCIPLES TO PATIENT EDUCATION

There are five principles to patient education (Hansel 1983):

1. The most effective motivation is based on the patient's understanding of the problem and of the benefits to be derived from the procedures advocated.
2. The patient's acquisition of knowledge should not necessarily be a major objective of a plaque control program. What counts is whether or not the patient removes the plaque everyday.
3. Take small steps. For majority of patients, their own perceived needs will be more meaningful and important to them than what the hygienist tells them their dental needs are.
4. The longer the elapsed time, the greater the chance that the behavior will not be repeated.
5. Positive reinforcement is anything that increases the probability that a behavior will be repeated.

Examples

An example of starting dialogue for laser bacterial reduction follows. However, make sure to modify any communication as needed to meet individual patient needs.

"Mr Smith, we have a new laser in our office, would you like to hear about the benefits it offers? It is amazing, and lowers the type of bacteria related to gum disease from billions down to hundreds. Overall your gums will feel healthier and you will receive a more optimal cleaning and benefit from it greatly. It is a \$35 procedure that doesn't hurt, and most insurance does not cover it. Would you like to try this today?"

If the patient agrees to the procedure, have him or her sign the consent form and place it in their chart for future reference (Figure 9.1).

An example of starting dialogue for laser-assisted periodontal therapy follows. However, make sure to modify any communication as needed to meet individual patient needs. "Mr. Smith you have gum disease! Have you ever been told this before? Would it be okay to share with you what gum disease is?"

Then discuss etiology of periodontal disease, pictures, intro-oral camera, and such. Then introduce the laser while discussed treatment recommended and continue, "The laser helps selectively remove pigmented diseased tissue while leaving healthy tissue alone. This helps to rebuild gum tissue and overall you will have a lot stronger foundation." Then show patient the treatment folder and brochures.

"Mr. Smith I have recommended that you come back and see me for a deeper more involved hygiene service as soon as possible. Your first appointment will consist of removing the major build up around your

Informed Consent for Periodontal Procedures

I understand that periodontal procedures (treatment involving the gum tissues and other tissues supporting the teeth) include risks and possible unsuccessful results from such treatment. Even though the utmost care and diligence is exercised in the treatment of periodontal disease and associated conditions through scaling and root planning, Laser and related procedures, there are no guarantees as to anticipated results. I agree to assume the following:

1. Response to treatment: because of many variables within each patient's physiological make-up, it is impossible to determine whether or not the healing process in which tissue response is a vital element will achieve the results desired by both Dr. Johnson and Jessica and the patient. Should the desired results not be attained, additional periodontal treatments may be required.
2. Postoperative patient responsibility for care: With the types of treatment required in correcting periodontal problems, it is important that the patient exercise extreme diligence in performing the home care prescribed and all recommended follow ups. With the necessary follow up by the patient, the probability of satisfactory results is greatly increased.
3. Bleeding/discomfort during or after treatment: the gums may bleed during or after treatment.
4. Recession of the gums after treatment: After treatment the gums may heal to a lower level on the tooth, this is called recession. While this is healthier position for the gums it may expose the edge of crowns or fillings, increase the sensitivity of teeth and cause wider spaces at the gum line between the teeth creating a black triangle.
5. Increased mobility (looseness) of teeth during the healing period.
6. Noise and water spray: Ultrasonic instruments can be noisy and the water spray they emit may be cold on teeth.
7. Local anesthetic and other drugs: Local anesthetic may be used and does carry its own risks including but not limited to: discomfort with administration and possible permanent paraesthesia.

I have been given the opportunity to ask any questions regarding the nature and purpose of periodontal treatment and have received answers to my satisfaction. I do voluntarily assume any possible risks, which may be associated with this treatment. By signing the form I authorize Dr. Johnson and Jessica Blayden to render the treatment advised based on my current dental condition including any necessary anesthetics and/or other medications.

Patient's name (print)

Patient's Signature or legal guardian

Date

Figure 9.1 Example of the consent form for periodontal treatment. This is used in the patient periodontal treatment folder. Courtesy of Jessica Blayden.

teeth. Also, I will introduce an involved home care routine that will take commitment from you. You have active gum disease and I need your help. Can you commit to doing better home care so we can work together as a team to get the best results? Then Dr. Johnson and I have recommended six sessions; each of these sessions will consist of using the laser around each tooth to lower the gum disease bacteria. We will numb your mouth and go below the gum line to get all the barnacles (calculus) off the tooth and to remove the infected tissue with the laser. Then I will bring you back for a follow up cleaning 6 weeks later to see how your tissue has healed. At this time we may retreat areas that are not resolved. Following this, I will see you 6 weeks later to measure your gum pockets and evaluate your tissue, this is when we celebrate all your hard work.

What questions do you have for me?"

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10

Insurance codes: how is laser paid for?

How laser is paid for with insurance is one of the most fundamental questions in laser dentistry. This chapter reviews how to pay for a laser with the hygiene applications that are performed with the soft-tissue diode laser. Each state varies as to regulations and codes, so it is imperative that the hygienist verify local and state regulations.

CURRENT CODES AND FEES

Let's discuss what the fees are in regard to insurance codes used currently in the United States from the CDT handbook provided by the American Dental Association. Examples will be given for California, one of the most aggressive states in incorporating and accepting new technology; Texas, a state that will not allow all the applications in the dental hygiene realm of laser dentistry to be used; and Calgary, Alberta, Canada, a province with strict guidelines as to what can and cannot be done. Please note that these prices are examples and are not used to dictate set prices for individual practices.

California

Hygiene codes

- 4355 Full-mouth debridement initial periodontal therapy (IPT), insurance will pay a portion: \$190

Soft-Tissue Lasers in Dental Hygiene, First Edition. Jessica Blayden and Angie Mott.
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- 4999 Services using laser bacterial reduction (LBR) as an adjunct to hygiene service use: \$32 full mouth (around the United States, the fee ranges between \$25 and \$40)
- 01110 Prophylaxis code (performed every 6 months): \$109 (insurance will pay every 6 months or twice a year)
- 4341/4342 Scaling and root planing (SRP) codes for localized one to three teeth or per quadrant per session: \$175–\$225 per session (insurance will pay a percentage)
- 4999.1 SRP/periodontal therapy with laser: \$175–\$225 per session
- 4999.2 Definitive therapy (DT): \$165 (6 weeks after periodontal therapy)
- 4910 Supportive periodontal therapy (SPT): \$165 (3 months after periodontal therapy, insurance will pay a percentage)
- 4342 Localized SRP, one to three teeth: \$175
- 4341 Quadrant of SRP, periodontal therapy: \$225
- 4999 Misc. code, any nonpaid service performed by the hygienist when using the laser. For example, LBR, laser-assisted periodontal therapy (LAPT) or laser de-epithelization-LAPT, or DT.
- Laser de-epithelization one to three teeth: \$175
- Laser de-epithelization per session: \$225
- 9910/1206 Desensitization (F12 varnish): \$50
- 7465/9110 Aphthous ulcer/herpetic lesion: \$50–\$150

Examples of pricing and use of insurance codes

Every state is different, so make sure to understand the regulations and laws within the state of practice. This example is based on four sessions of LAPT.

Phase 1:

4355 IPT full-mouth debridement: \$190

Phase 2:

4341: QUAD, code 4342: One to three teeth

SRP: \$225, Laser: \$225 = \$450 LAPT × 4 sessions = \$1800

– 720 (insurance pays 80% of \$225 × 4 sessions) = \$1080 out of pocket

Phase 3:

4999 DT: \$165

4910 SPT: \$165

Program total: \$2320

Insurance pays: \$1075

Patient portion: \$1245 out of pocket divided by six appointments = \$207.50

Block schedules ahead of time for periodontal patients

Scheduling options

1. Patient gets 10% off total treatment plan for paying up front, schedule all appointments
2. Patient pays one appointment in advance and schedule just that one appointment
3. CareCredit: 0% for 12 months, doctor pays 7% (can be negotiated down to 3–4%) but gets paid up front; schedule all appointments

Texas

Hygiene codes

- 4355 Full-mouth debridement IPT, insurance will pay a portion: \$190
- 4999 Services using LBR as an adjunct to hygiene service use: \$32 full mouth (around the United States, the fee ranges between \$25 and \$40)
- 01110 Prophylaxis code (performed every 6 months): \$109 (insurance will pay every 6 months or twice a year)
- 4341/4342 SRP codes for localized one to three teeth or per quadrant: \$175–\$225 per session (insurance will pay a percentage)
- 4999.1 SRP/periodontal therapy with laser: \$175–\$225 per session
- 4999.2 DT: \$165 (6 weeks after periodontal therapy)
- 4910 SPT: \$165 (3 months after periodontal therapy, insurance will pay a percentage)
- 4342 Localized SRP one to three teeth: \$175
- 4341 Quadrant of SRP-periodontal therapy: \$225
- 4999 Misc. code, any nonpaid service performed by the hygienist when using the laser. For example: LBR, LAPT, laser de-epithelization-LAPT, or DT.
- Laser de-epithelization one to three teeth: \$175
- Laser de-epithelization per session: \$225
- 9910/1206 Desensitization (Fl2 varnish): \$50
- 7465/9110 Aphthous ulcer/herpetic lesion: \$50–\$150

Examples of pricing and use of insurance codes

Every state is different, so make sure to understand the regulations and laws within the state of practice. This example is based on four sessions of LAPT.

Phase 1:

4355 IPT full-mouth debridement: \$190

Phase 2:

4341: QUAD, 4342: one to three teeth

SRP\$ \$225, Laser: \$225 = \$450 LAPT × 4 sessions = \$1800

Hygienists in Texas cannot initiate the fiber. “Always check with your state dental board to ensure what applications can and cannot be performed with the laser.” However, the same technique described with an initiated tip can be done using an uninitiated fiber. This allows the soft-tissue diode laser to do what it naturally is meant to do, and when exposed to target tissue, the laser optic fiber absorbs melanin and hemoglobin only when diseased/infected tissue is present. The hygienist would then wipe the fiber with a wet gauze. However, the doctor could do this portion of the examination and bill it as a gingivectomy, if cost is a concern to the patient.

–\$720 (insurance pays 80% of $\$225 \times 4$ sessions)

\$1080 out of pocket

Phase 3:

- 4999 DT: \$165
- 4910 SPT: \$165
- Program total: \$2320
- Insurance pays: \$1075
- Patient portion: $\$1245$ out of pocket divided by 6 appointments = \$207.50
- Block schedules ahead of time for periodontal patients

Scheduling options

1. Patient gets 10% off total treatment plan for paying up front; schedule all appointments
2. Patient pays one appointment in advance and schedule just that one appointment
3. CareCredit: 0% for 12 months, doctor pays 7% (can be negotiated down to 3–4%) but gets paid up front; schedule all appointments

Example in Calgary, Alberta, Canada

In Calgary, according to the College of Registered Hygienists in Alberta, the hygienist can only initiate the fiber *if necessary*. However, this changes across provinces; it is the responsibility of the hygienist to know and follow regulations for the state or province within which he or she operates.

Codes for Calgary, Alberta, Canada

- 11111–11116 Scaling units: \$60 per Unit (15 minutes per unit)
- 43421 Root planing code: \$60 per unit (15 minutes per unit)
- 42111 Curettage code per sextant: \$225
- 99557 Misc code, any laser applications in dental hygiene or any additional expense.
- 41211 Soft-tissue oral manifestations, aphthous ulcer, herpetic lesion: \$57.00 per unit
- 41301 Desensitization code/FI2 varnish: \$50–\$150

This example is based on six sessions of LAPT.

Phase 1:

11111–11117 IPT remove all major debris/gross debridement: \$60 per unit $\times 3 = \$180$

Phase 2:

- 43421 Root planning: \$60 per unit
- 42111 Curettage per sextant “or Use unit of Scaling/Root planing as a laser unit”: \$225
- 16 units = $\$960 + 6 \times \$225 = \$2310$
- Insurance pays 50–80% of this total which is: \$1848

Phase 3:

DT (6 weeks after therapy):

- 11111–11117 $\$60 \times 2 + \text{LBR} = \152

SPT (3 months after therapy):

- 11111–11117: $\$60 \times 2 + \text{LBR} = \152
- Program total: \$2794.00
- Insurance pays: \$2180.00
- Patient portion: \$614 out of pocket expense divided by six appointments = \$103 per appointment

Scheduling options

1. Patient gets 10% off total treatment plan for paying up front, schedule all appointments
2. Patient pays one appointment in advance and schedule just that one appointment
3. CareCredit: 0% for 12 months, doctor pays 7% (can be negotiated down to 3–4%) but gets paid up front; schedule all appointments. In Canada there is a type of care credit, it is called by a different name, however, it is the same concept as care credit.

RETURN ON INVESTMENT

Increasing production within the hygiene department is imperative. Appropriate diagnosing and correct scheduling are the best ways to get a return on an investment on a laser. Because upward of 80% of patients have periodontal disease, 80% of patients should require supportive periodontal therapy.

- 2 Prophylaxis $\$109(\text{prophy}) + \$35 (\text{LBR}) = \$144$
- Codes: 01110, 4999
- 4 SPT: \$165.00
- Codes: 4910, 4999

- 2 sessions LAPT: \$450.00
- SRP code 4341/4342 and LAPT code 4999.1
- An average day production and perfect day schedule. \$1700–\$2000 a day average
- \$360,000 (4 days–50 weeks)/28,800 mo
- \$400,000 (4 days–50 weeks)/32,000 mo

Here is an example of increasing production using just the one application and incorporating LBR to each hygiene service rendered.

- 5 patients $\times$ \$35 = \$175 a day increase
- $\times$ 4 days: \$700 a week increase
- $\times$ 4 weeks/1 month: \$2800 a month increase
- $\times$ 12 months: \$33,600 a year increase

The most important reason to use the laser is not to increase production but for the health of the patient. By using the laser, the standard of care for patients will be raised and they will have the most advanced technology available for treating gum disease.

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11

Laser cases

With any of these cases presented, it is important to note that periodontal disease is site specific and episodic in nature, and many factors, which are covered in Chapter 5, can also play a role on the type of results. The pathogenesis of periodontal disease and the methods of treating it have undergone radical changes in the past 30 years. The contemporary model for periodontal disease includes microbial components, host-inflammatory responses, and host-risk factors that contribute to the disease progression (Kim and Amar 2006). With the help of lasers, periodontitis, which can not be cured, can be controlled.

Abbreviations used

The following cases and images use the following abbreviations:

BOP	bleeding on probing
CW	continuous wave
CHX	chlorhexidine
D	distal
DF	distal facial
DL	distal lingual
DT	definitive therapy
FM	full mouth
IP	interproximally
IPT	initial periodontal therapy

IT	Initiated Tip
LAPT	laser-assisted periodontal therapy
LBR	laser bacterial reduction
LL	lower left
LR	lower right
MB	mesial buccal
OHI	oral hygiene instruction
SPT	supportive periodontal therapy
SRP	scaling and root planing
UIT	uninitiated tip
UL	upper left
UR	upper right
USS	ultrasonic scaler
W	watts

Standard cases
Case 1

GINGIVITIS

- Bright red or bluish color
- Bulbous, blunted, cratered, or flattened papilla
- Rounded or rolled margins
- Soft or spongy tissue
- BOP
- No pockets larger than 3 mm
- Treatment takes 2– hours

Nick

Age: 17-year-old male

Health: Healthy

Clinical findings

- Generalized gingivitis
- Generalized 4 mm present
- Moderate-heavy bleeding
- Generalized acute papillary edema
- Light tartar lower anteriors/UR, UL quadrant buccal molars
- Moderate plaque IP
- No radiographic bone loss
- Psuedopocketing because of hypertrophic tissue.

Treatment

Make sure with all treatment phases to include informed consent for LAPT rendered; protective eyewear is worn for both operator and patient; use of highest filtration masks (Class V or 0.1 micron); the environment is secured to limit access; laser-in-use warning sign placed; and reflective surfaced minimized.

The course of treatment will be prophy of FM debridement with LBR and a home care regimen.

Prophy with LBR

1. Prerinse.
2. LBR 1.5W pulsed, eyewear worn, FM, UIT 1/2mm in the sulcus for 10–15 seconds per tooth.
3. Coronal polishing before scaling; it will eliminate plaque at a far greater rate and reduce the amount of time scaling each patient.
4. Use of micro-ultrasonics for debris and biofilm removal.
5. Hand scaling in the appropriate areas to ensure that all calculus is eliminated.
6. Selective polishing if needed in those areas that had high amounts of calculus.

Follow-up

A 1-month follow-up prophylaxis with LBR FM and continue 1-month interval prophylaxes until gingivitis is healed. Applying the same steps during 1-month follow-ups and all other future appointments until stability is achieved.

Home care

Fair

OHI recommended

- Rotadent twice a day
- Flossing once a day
- Dip/brush with end-tuft IP gingiva with CHX gluconate 0.12% once day

Maintenance

Three- to 4- month prophylaxis with LBR FM and continual refining OHI.

Case presentation

Nick is a 17-year-old man with a clean health history and no medications. He presented with the preceding description of his tissue and with 55 areas of bleeding sites and fifty-five 4-mm sites (Figures 11.1 and 11.2). He never brushed, never flossed, or did any type of home care. He agreed to brush. The Rotadent electric toothbrush was recommended. His goal was to use the electric toothbrush four times a week and that he should return in



Figure 11.1 Gingivitis. Reprinted from Karimbux, N. 2012, *Clinical Cases in Periodontics*, with permission from Wiley-Blackwell.

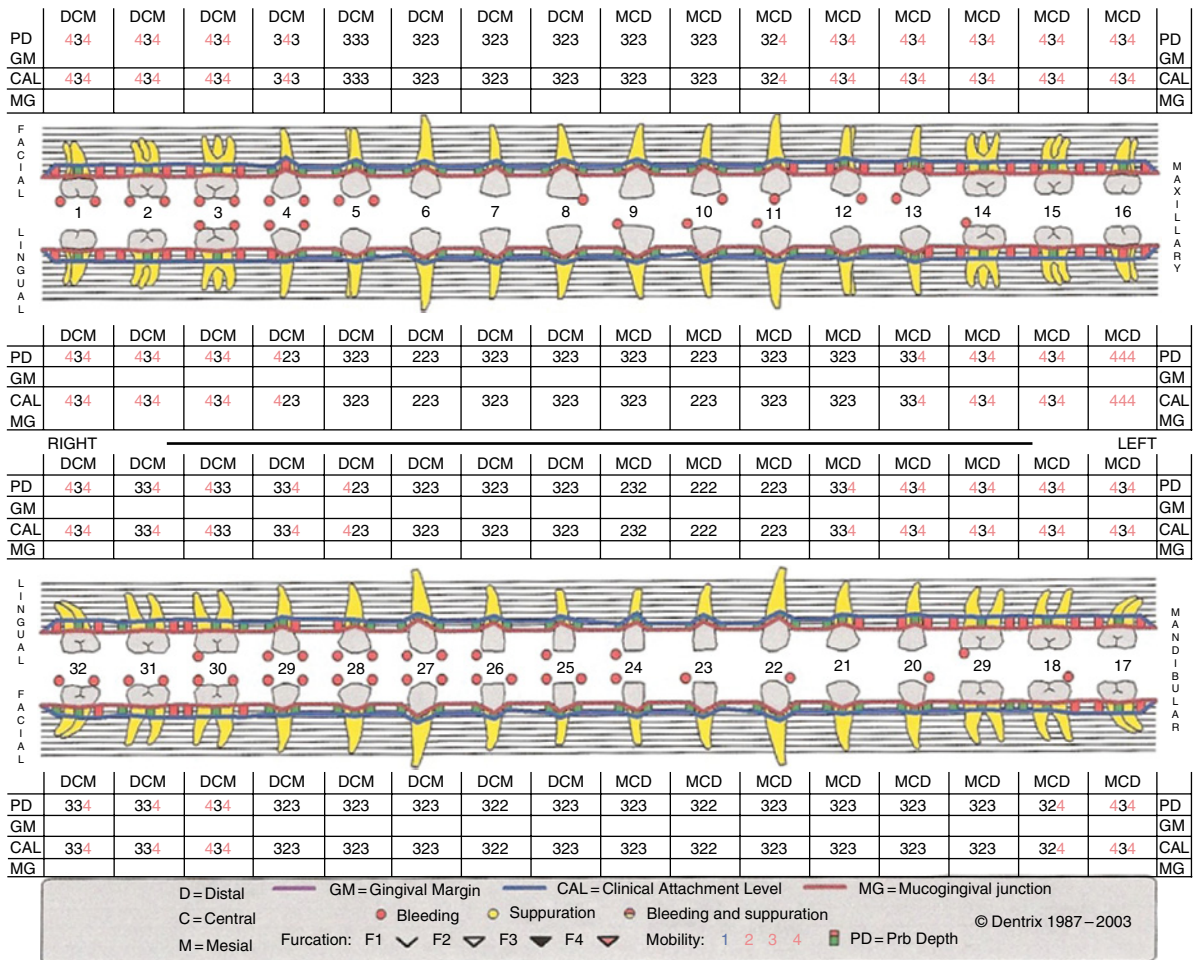


Figure 11.2 Initial periodontal probing assessment: BOP=55, 4 mm=55.

1 month. Treatment recommended was a prophylaxis of his FM with LBR and a home care regimen. The treatment was LBR at 1.5W pulsed for 5 minutes FM and then teeth cleaning each visit. No periodontal therapy was incorporated for treatment because there were 4-mm pseudopockets and no radiographic bone loss.

At the 1-month follow up appointment (Figure 11.3) Nick had major improvement. At this appointment, flossing was incorporated in addition to the once-a-day brushing with the electric toothbrush. The ideal hygiene protocol would be to continue to see the patient once a month until the gingivitis was controlled and the gums were healthy. He was set on a 4-month recare program, which meant seeing him 1 month and then a 3-month recare if the gingivitis was eliminated. The prognosis of this patient is good as long as the patient conforms to good oral hygiene and recommended interval for professional hygiene services every 4 months to control reoccurring gingivitis.

Short-term goals

- Initiate good plaque control with an oral hygiene program tailored to the patient's needs.
- Work on goals to better home care and improve gingivitis.
- Motivate patient to see the whole picture involved with his mouth and maintain a high level of oral hygiene.

Long-term goals

- Patient returns to health and controls inflammation to stay at health.

Clinical notes

- First appointment: LBR 1.5W pulsed FM, UIT; and eyewear worn.
- Second appointment: LBR 1.5W pulsed FM, UIT; and eyewear worn.

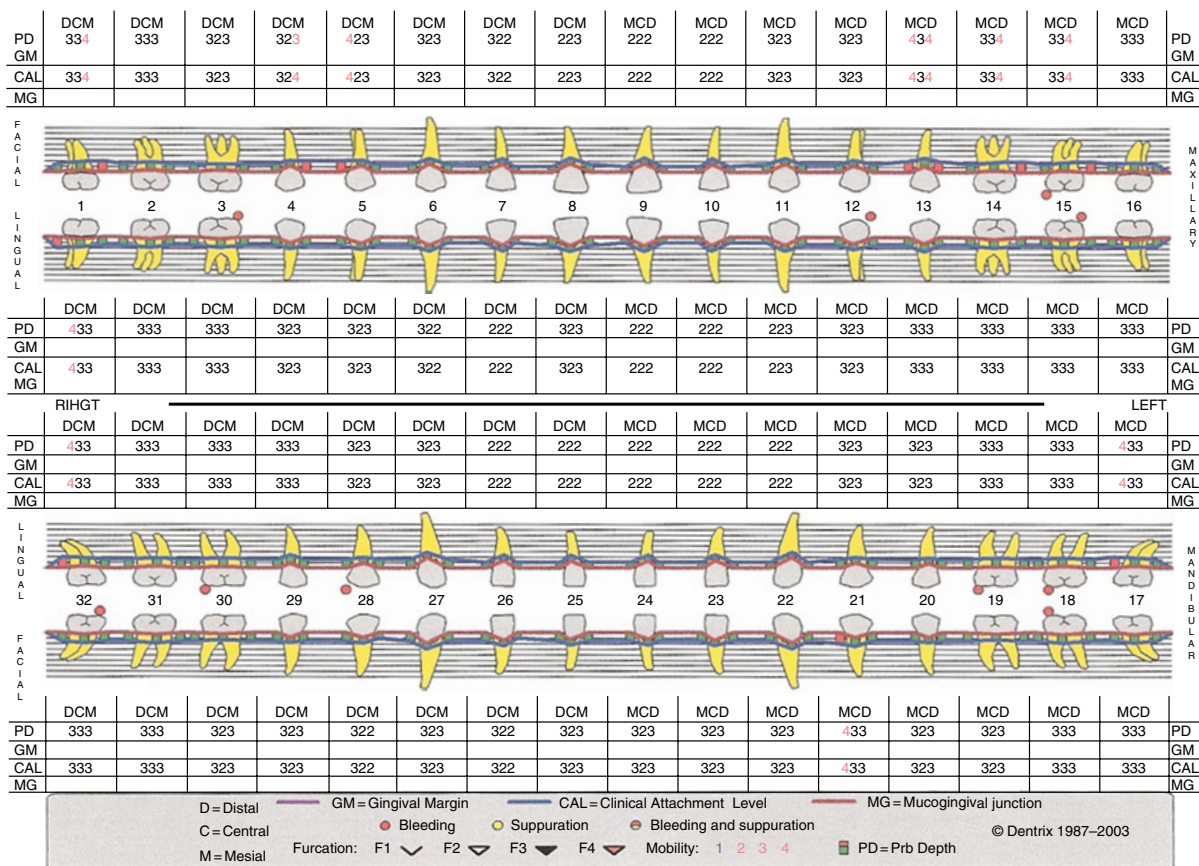


Figure 11.3 One-month: BOP = 10, 4 mm = 11.

Case 2

BORDERLINE PERIODONTAL DISEASE CASE

- Inflamed tissue (C-reactive proteins)
- BOP
- Pockets, 3–4 mm, on posterior teeth in one to two quadrants in mouth
- Rough subgingival root surfaces
- Subgingival calculus
- Treatment takes 2–4 hours

Janet

AGE: 28-year-old female

Health: Healthy

Clinical findings:

- Localized early periodontitis
- Localized 4 mm present
- Moderate-heavy bleeding
- Generalized acute papillary edema
- Light tartar sub- and supragingival lower anteriors/UR, UL quadrant buccal molars
- Moderate plaque IP, line angles and along gingival margin
- Slight localized radiographic bone loss

Treatment

Make sure with all treatment phases to include informed consent for LAPT rendered; protective eyewear is worn for both operator and patient; use of highest filtration masks (Class V or 0.1 micron); the environment is secured to limit access; laser-in-use warning sign placed; and reflective surfaced minimized.

The course of treatment will be IPT with FM debridement and LBR and a home care regimen.

IPT with LBR

1. Prerinse.
2. LBR 1.5W pulsed, FM, UIT, 10–15 seconds per tooth, 5 minutes FM.
3. Disclose the patient.
4. Go over home care recommendations; do *not* overwhelm the patient.
5. Use USS FM debride.
6. LBR may need to be done again or for the first time because too much calculus is present.
7. FM periodontal probing.
8. Organize treatment protocol and present to patient.

First session

1. Numb UR and LR quadrants.
2. LBR 1.5W pulsed, FM, UIT while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers.
4. LAPT-de-epithelization <1 mm of pocket depth; in this case with 4 mm at 3 mm, initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in UR and LR quadrants.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength or tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Second session

1. Numb UL and LL quadrants.
2. LBR 1.5W pulsed, FM, UIT while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers; biofilm removal for UR and LR quadrants with USS; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1 mm of the pocket depth, in this case 4 mm at 3 mm, initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in the UL and LL quadrants. Evaluate UR and LR quadrants to see if any areas are in need of retreat from the week before, even though in this case the 4 mm were treated at 3 mm.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Six-week DT follow-up with LBR

1. Prerinse.
2. LBR: 1.5W pulsed, FM, UIT, 10–15 seconds per tooth, 5 minutes FM.
3. Review and encourage oral hygiene regimen, and add any home care tools necessary.
4. Gentle cleaning, removing any reintroduced plaque or calculus.

5. Retreat any bleeding areas using USS, hand instruments, and the laser, calibrating the fiber to be 3mm.
6. Set up 3-month recare, which is 6 weeks from this visit.

Six-week SPT probing

This is set 3 months after treatment.

1. Prerinse.
2. LBR: 1.5W pulsed, FM, UIT, 10–15 seconds per tooth, 5 minutes FM.
3. Review and encourage oral hygiene regimen, and add any home care tools necessary.
4. Probe and celebrate any positive results.
5. Gentle cleaning, removing any reintroduced plaque or calculus.
6. Retreat any bleeding areas, unresolved pockets using USS, hand instruments, and the laser, calibrating the fiber to be <1mm of the pocket depth.
7. Reimplement into laser therapy or set up 3-month recare appointment.

Home care

Fair

- Rotadent twice a day.
- Flossing once a day.
- Dip/brush IP gingiva with CHX gluconate 0.12% once a day.
- Tool kit by OMNI once a day (control prescription, toothpaste, floss, and periomed rinse).

Maintenance

Three-month SPT with LBR and continually refining OHI.

Case presentation

Janet had borderline periodontal disease. Borderline because all four quadrants had one to three teeth localized and were combined to be in one to two quadrants equivalency. Janet was treated in two sessions with the 4-mm pockets being treated at 3mm each session (Figures 11.4, 11.5, and 11.6). Three months following LAPT sessions, the 4mm was treated at 3mm with the laser at 0.8 CW and administering LBR 1.5W pulsed FM at the beginning and to the infected areas of the SPT appointment to reduce bacteria. Then she was placed on 3-month recare.

The prognosis of this patient is good as long as the patient conforms to good oral hygiene and recommended interval for professional hygiene services every 3 months to manage and maintain her periodontal condition at a higher standard.

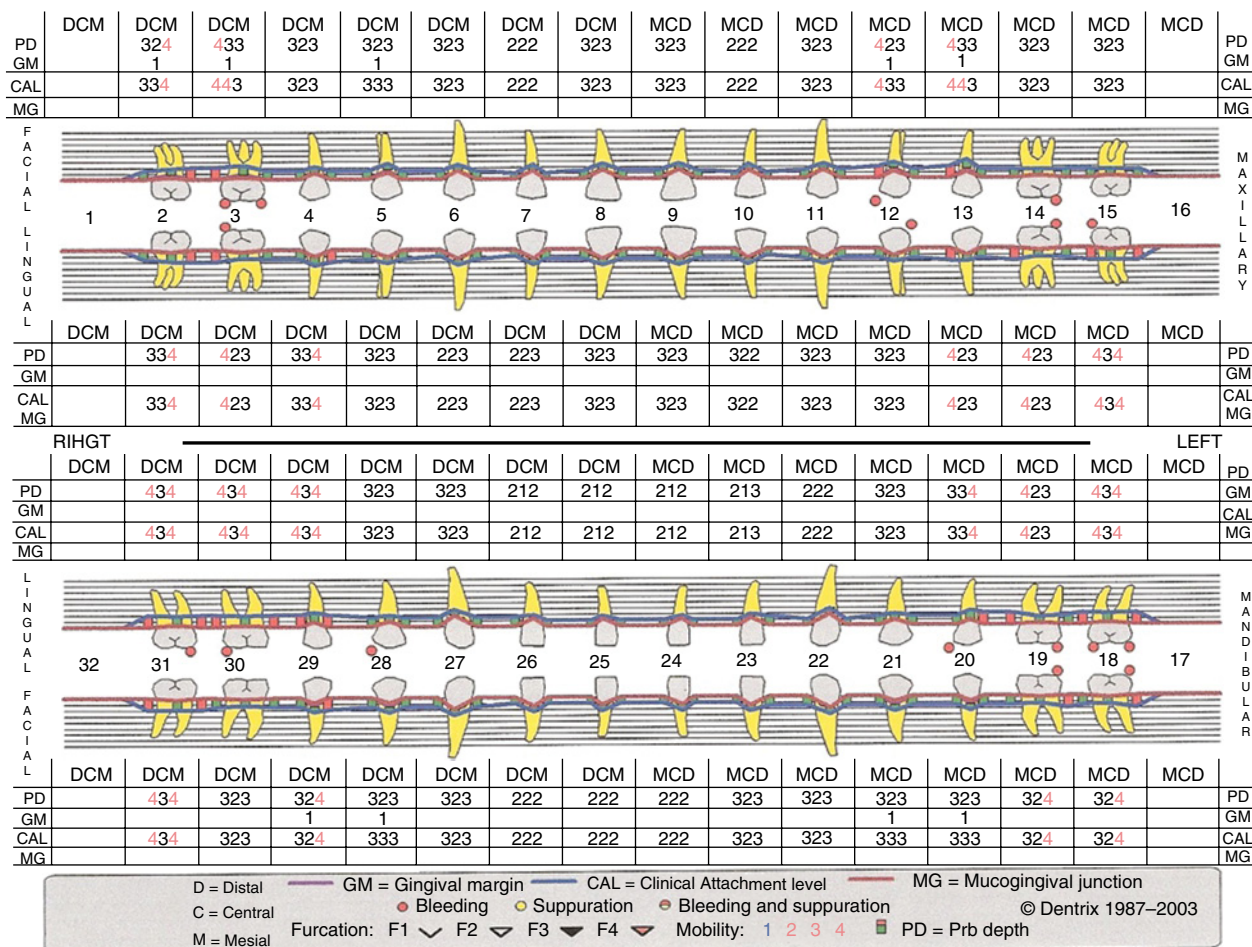


Figure 11.4 Initial periodontal probing assessment: BOP = 18, 4 mm = 26.



Figure 11.5 After photo #29MB: 2 mm, before 4 mm present.

Short-term goals

- Initiate good plaque control with an oral hygiene program tailored to the patient's needs.
- Work on goals to better home care and improve localized periodontal sites.
- Motivate patient to see the whole picture involved with her mouth and maintain a high level of oral hygiene.

Long-term goals

- Patient returns to health and controls inflammation to stay at health.
- Get veneers for #7 & #10.
- Improve periodontal condition with a gain in clinical attachment levels.
- Help patient maintain a high level of oral hygiene.

Clinical notes

- First appointment: LBR 1.5W pulsed FM; UR and LR curettage 0.8 CW; LBR 1.5W pulsed with 4mm at 3mm; eyewear worn; and vitamin E placed.
- Second appointment: LBR 1.5W pulsed FM; UL and LL curettage 0 to 0.8 CW; LBR 1.5W pulsed with 4mm at 3mm; eyewear worn; and vitamin E placed.

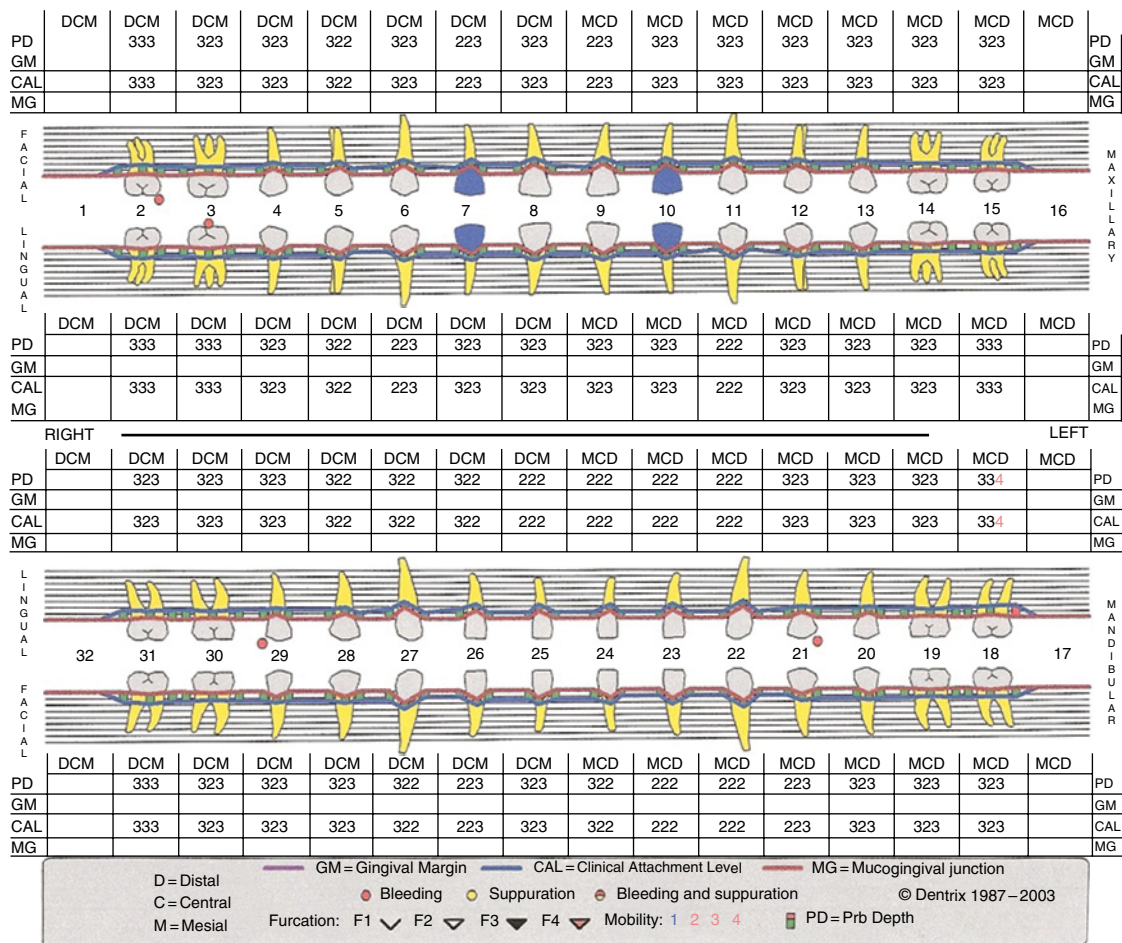


Figure 11.6 Three-month SPT: BOP = 4, 4 mm = 1.

Case 3

EARLY PERIODONTAL DISEASE CASE

- Inflamed tissue
- BOP
- Pockets, 4mm, on posterior teeth generalized in all quadrants
- Rough subgingival root surfaces
- Subgingival root calculus
- Treatment takes 4–6 hours

Don

AGE: 39-year-old male

Health: Healthy

Clinical findings:

- Generalized early periodontitis
- Generalized 4 mm present
- Heavy bleeding upon scaling/lasing
- Generalized acute marginal edema
- Generalized supra- and subgingival light tartar (veneer like)
- Moderate plaque IP and along gingival margin
- Early radiographic bone loss

Treatment

Make sure with all treatment phases to include informed consent for LAPT rendered; protective eyewear is worn for both operator and patient; use of highest filtration masks (Class V or 0.1 micron); the environment is secured to limit access; laser-in-use warning sign placed; and reflective surfaced minimized.

The course of treatment will be IPT with FM debridement and LBR and a home care regimen.

IPT with LBR

1. Prerinse
2. LBR 1.5W pulsed, FM, UIT, 10–15 seconds per tooth, 5 minutes FM.
3. Disclose the patient.
4. Go over home care recommendations; do *not* overwhelm the patient.
5. Use USS to FM debride.
6. LBR may need to be done again or for the first time because too much calculus is present.
7. FM periodontal probing.
8. Organize treatment protocol and present to patient.

First session

1. Numb UL quadrant.
2. LBR 1.5W pulsed, FM, UIT while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers.
4. LAPT-de-epithelization <1mm of pocket depth, in this case 4mm at 3mm, initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in UL quadrant.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Second session

1. Numb UR quadrant.
2. LBR 1.5W pulsed, FM, UIT while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers; biofilm removal for UL quadrant with USS; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1mm of pocket depth, in this case 4mm at 3mm, initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in UR quadrant. Evaluate UL quadrant to see if any areas are in need of retreat from the week before even though in this case the 4mm were treated at a 3mm.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Third session

1. Numb LL quadrant.
2. LBR 1.5W pulsed, FM, UIT while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers; biofilm removal for UR and UL quadrants with USS; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1mm of pocket depth, in this case 4mm at 3mm, initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in LL quadrant. Evaluate UR and UL quadrants to see

if any areas are in need of retreat from the week before even though in this case the 4mm were treated at a 3mm.

5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Fourth session

1. Numb LR quadrant.
2. LBR 1.5W pulsed, FM, UIT while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers; biofilm removal for UR, UL, and LL quadrants with USS; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1mm of pocket depth, in this case 4mm at 3mm, initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in LR quadrant. Evaluate UR, UL, and LL quadrants to see if any areas are in need of retreat from the week before even though in this case the 4mm were treated at a 3mm.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Six-week DT follow-up with LBR

1. Prerinse.
2. LBR: 1.5W pulsed, FM, UIT, 10–15 seconds per tooth, 5 minutes FM.
3. Review and encourage OHI, and add any home care tools necessary.
4. Gentle cleaning, removing any reintroduced plaque or calculus.
5. Retreat any bleeding areas using USS, hand instruments, and the laser, calibrating the fiber to be 3mm.
6. Set up 3-month recare, which is 6 weeks from the DT visit.

Six-week SPT with probing

This is set 3 months after treatment.

1. Prerinse.
2. LBR: 1.5W pulsed, FM, UIT 10–15 seconds per tooth, 5 minutes FM.
3. Review and encourage OHI, and add any home care tools necessary.
4. Probe and celebrate any positive results.
5. Gentle cleaning, removing any reintroduced plaque or calculus.

6. Retreat any bleeding areas, unresolved pockets using USS, hand instruments, and the laser, calibrating the fiber to be <1 mm of the pocket depth.
7. Reimplement into laser therapy or set up 3-month recare.

Home care

Excellent

OHI recommended

- Rotadent twice a day
- Flossing twice a day
- Dip/brush IP gingiva with CHX gluconate 0.12% 1xday
- Tool kit by OMNI once a day (control prescription, toothpaste, floss and periomed rinse)

Maintenance

Three-month SPT with LBR with continual refining of OHI.

Case presentation

Don presented with generalized early periodontal disease. He was skeptical because he remembered having something done before with a laser but was not sure how it was done. Benefits of the technology and successful cases were discussed. He agreed to four sessions and in all and treated the 4-mm pockets at 3 mm (Figures 11.7–11.9, and 11.10). Three months following LAPT sessions there were no 4-mm pockets present, so LBR at 1.5W pulsed FM at the beginning of the SPT appointment to reduce bacteria was used. Hygiene service was then provided and the patient was placed on a 3-month recare.

The prognosis of this patient is great with his excellent as long as the patient continues to conform to this good oral hygiene and recommended



Figure 11.7 Early periodontal disease before #3MB: 4 mm.

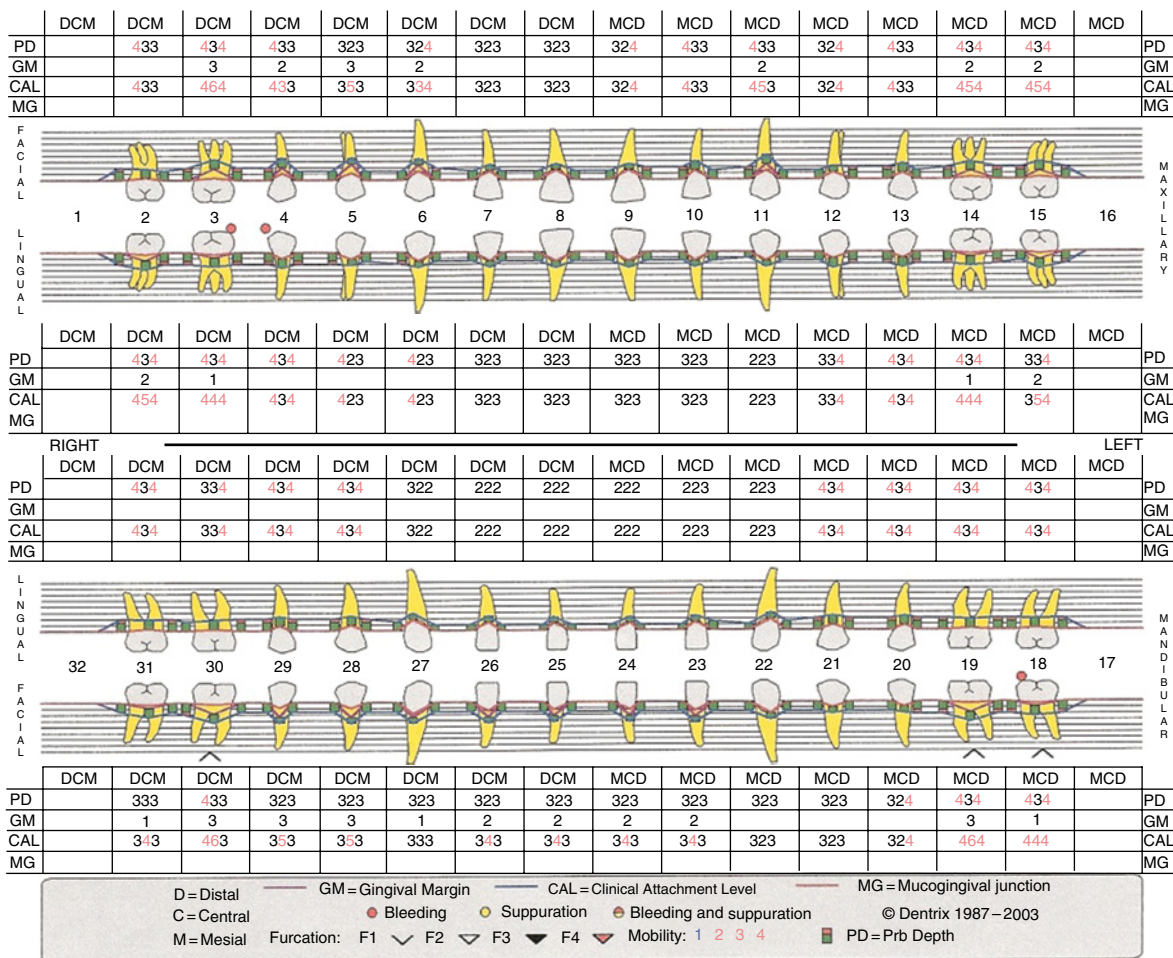


Figure 11.8 Initial periodontal probing assessment: BOP = 3, upon scaling = generalized, 4 mm = 49.



Figure 11.9 After photo.

interval for professional hygiene services every 3 months to manage and maintain his periodontal condition at a higher standard.

Short-term goals

- Initiate good plaque control with an oral hygiene program tailored to the patient's needs.
- Motivate patient to see the whole picture involved with his mouth and maintain a high level of oral hygiene and why laser is beneficial compared to conventional SRP treatment rendered 1 year previous.

Long-term goals

- Patient returns to health and controls inflammation to stay at health.
- Improve periodontal condition with a gain in clinical attachment levels.

Clinical notes

- First appointment: LBR 1.5W pulsed FM; UL curettage 0.8 CW; LBR 1.5 W pulsed 4 mm at 3 mm; eyewear worn; and vitamin E placed.
- Second appointment: LBR 1.5W pulsed FM; UR curettage 0.8 CW; LBR 1.5W pulsed 4 mm at 3 mm; eyewear worn; and vitamin E placed.
- Third appointment: LBR 1.5W pulsed FM; LL quadrant curettage 0.8 CW; LBR 1.5W pulsed 4 mm at 3 mm; eyewear worn; and vitamin E placed.
- Fourth appointment: LBR 1.5W pulsed FM; LR quadrant curettage 0.8 CW; LBR 1.5W pulsed 4 mm at 3 mm; eyewear worn; and vitamin E placed.

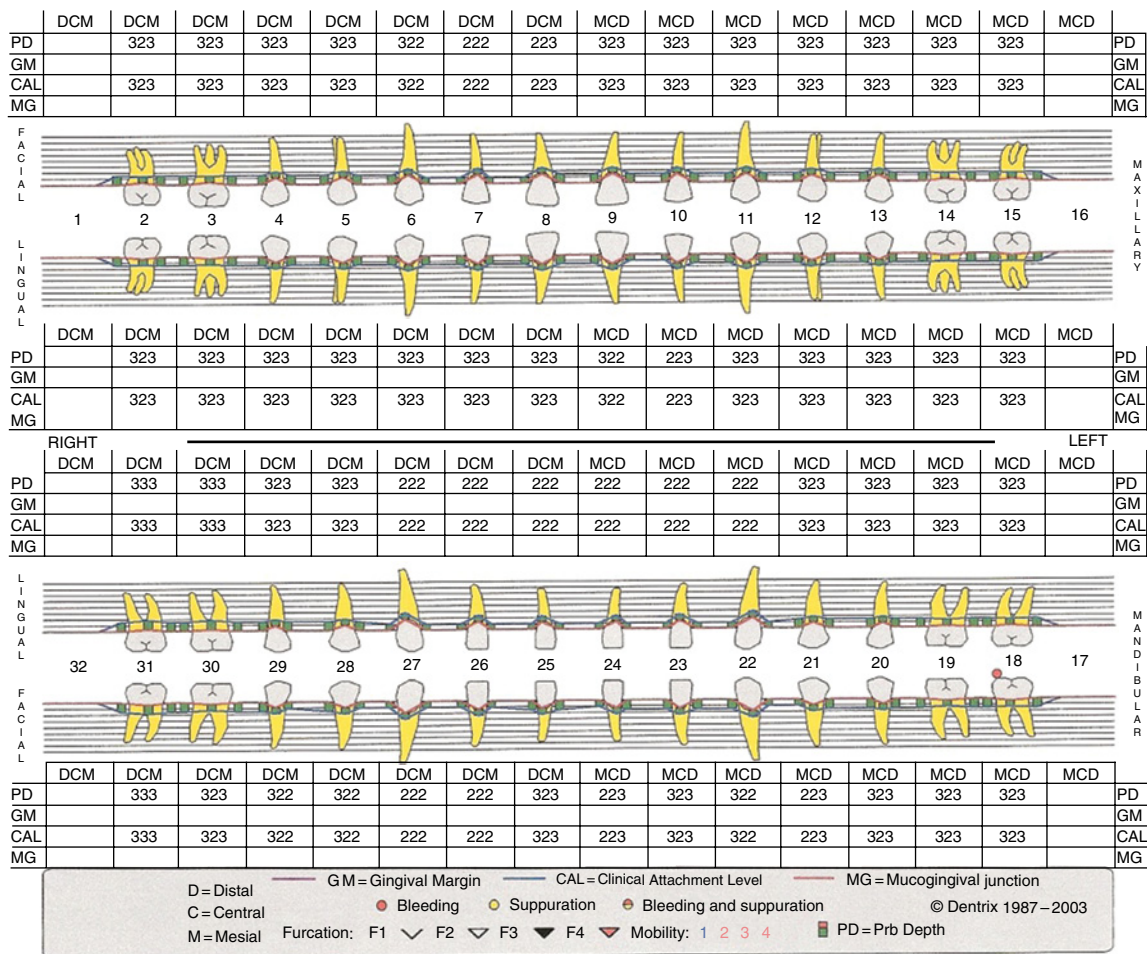


Figure 11.10 Three-month SPT: BOP = 14 mm = 0.

Case 4

MODERATE PERIODONTAL DISEASE CASE

- Inflamed tissue
- BOP
- Pockets, 5–6 mm, on posterior teeth sporadic or generalized in all quadrants
- Rough subgingival root surfaces
- Subgingival calculus
- Beginning mobility
- Treatment takes 6–8 hours

Leonard

AGE: 58-year-old male

Health: Few allergies; arthritis in hands and joints (fair dexterity)

Meds: Claritin

Clinical findings:

- Generalized moderate periodontitis
- Generalized 4–6 mm present
- Moderate bleeding present/furcation involvement
- Generalized acute marginal edema
- Generalized supra- and subgingival moderate tartar
- Moderate plaque IP and along gingival margin both buccal and lingual
- Posterior moderate radiographic bone loss

Treatment

Make sure with all treatment phases to include informed consent for LAPT rendered; protective eyewear is worn for both operator and patient; use of highest filtration masks (Class V, or 0.1 micron); the environment is secured to limit access; laser-in-use warning sign placed; and reflective surfaced minimized.

The course of treatment will be IPT with FM debridement and LBR and a home care regimen.

IPT with LBR

1. Prerinse.
2. LBR 1.5W pulsed, FM, UIT, 10–15 seconds per tooth, 5 minutes FM.
3. Disclose the patient.
4. Go over home care recommendations; do *not* overwhelm the patient.
5. Use USS FM debride.

6. LBR may need to be done again or for the first time because too much calculus is present.
7. FM periodontal probing.
8. Organize treatment protocol and present to patient.

Eight periodontal therapy sessions

First session

1. Numb LL quadrant teeth #17–#21 premolars and molars.
2. LBR 1.5W pulsed, FM, UIT while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers.
4. LAPT-de-epithelization <1mm of pocket depth, in this case 6mm at 5mm, and other pockets in the area worked on <1mm of previous pocket depth (i.e., 5mm at 4mm, 4mm at 3mm, and so on) initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in LL quadrant.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Second session

1. Numb UL quadrant #12–#16 premolars and molars and place topical anesthetic on LL quadrant.
2. LBR 1.5W pulsed, FM, UIT while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers; biofilm removal for LL quadrant with USS; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1mm of pocket depth, in this case 6mm at 5mm, and other pockets in the area worked on <1mm of previous pocket depth (i.e., 5mm at 4mm, 4mm at 3mm, and so on) initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in UL quadrant and retreat LL quadrant at 6mm at 4mm, which is <1mm from the week before.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Third session

1. Numb UR quadrant #1–#5 premolars and molars and place topical anesthetic on UL and LL quadrant.
2. LBR 1.5 W pulsed, FM, UIT while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers; biofilm removal for UL and LL quadrants with USS; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1 mm of pocket depth, in this case 6 mm at 4 mm, and other pockets in the area worked on <1 mm of previous pocket depth (i.e., 4 mm at 3 mm and so on) initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in UR quadrant and retreat UL quadrant with 6 mm at 4 mm, LL quadrant with 6 mm at 3 mm.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5 W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Fourth session

1. Numb LR quadrant #32–#28 and place topical anesthetic on UL and UR quadrants.
2. LBR 1.5 W pulsed, FM, UIT while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers; biofilm removal for UR and UL quadrants with USS; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1 mm of pocket depth, in this case 5 mm at 4 mm, and other pockets in the area worked on <1 mm of previous pocket depth (i.e., 4 mm at 3 mm and so on) initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in LR quadrant and retreat UR quadrant with 6 mm at 4 mm and UL quadrant with 6 mm at 3 mm.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5 W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Fifth session

1. Numb upper anterior teeth and place topical anesthetic on UR and LR quadrants.
2. LBR 1.5 W pulsed, FM, UIT while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers; biofilm removal for UR and LR quadrants with USS; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1 mm of pocket depth, in this case 4 mm at 3 mm, initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in upper anterior teeth and retreat LR quadrant with 5 mm at 3 mm, and UR quadrant with 6 mm at 3 mm.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5 W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Sixth session

1. Numb lower anterior teeth.
2. LBR 1.5 W pulsed, FM, UIT while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers.
4. LAPT-de-epithelization <1 mm of pocket depth, in this case 4 mm at 3 mm, initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in UR and LR quadrants.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5 W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Six-week DT follow-up with LBR

1. Prerinse.
2. LBR: 1.5 W pulsed, FM, UIT 10–15 seconds per tooth, 5 minutes FM.
3. Review and encourage OHI, and add any home care tools necessary.
4. Gentle cleaning, removing any reintroduced plaque or calculus.
5. Retreat any bleeding areas using USS, hand instruments, and the laser, calibrating the fiber to be 3 mm.
6. Set up 3-month recare, which is 6 weeks from the DT visit.

Six-week SPT with probing

This is set 3 months after treatment.

1. Prerinse.
2. LBR: 1.5W pulsed, FM, UIT, 10–15 seconds per tooth, 5 minutes FM.
3. Review and encourage OHI, and add any home care tools necessary
4. Probe and celebrate any positive results.
5. Gentle cleaning, removing any reintroduced plaque or calculus.
6. Retreat any bleeding areas, unresolved pockets using USS, hand instruments, and the laser, calibrating the fiber to be <1 mm of the pocket depth.
7. Reimplement into laser therapy or set up 3-month recare.

Home care

Good

OHI recommended

- Rotadent twice a day
- Flossing twice a day
- Dip/brush IP gingiva with CHX gluconate 0.12% once a day
- Tool kit by OMNI once a day (control prescription, toothpaste, floss, and periomed rinse)
- Water pick once a day was added on his 3-month SPT follow-up visit

Maintenance

Three-month SPT with LBR with continual refining OHI.

Case presentation

Leonard had moderate periodontal disease. Using the treatment formula discussed in Chapter 8 (adding the deepest pockets in all four quadrants and dividing it by four equals six sessions). It was kept at six sessions to get all pockets at 3 mm in theory. Using the eight steps in the classic appointment, the most involved area was treated first. And using laser only, treated the 6-mm pockets at 5 mm, 5-mm pockets at 4 mm, 4-mm pockets at 3 mm and used the laser for LBR FM on 1.5 W for 5 minutes and then treated each diseased pocket placing the laser on settings 0.8 CW for 10–15 seconds each pocket. Then flushed out the dead necrotic tissue with the USS. This is followed by LBR at 1.5W pulsed, 15–20 seconds per tooth both buccal and lingual just in these diseased areas to create biostimulation within the pocket (Figures 11.11–11.13, and 11.14). At the treatment assessment at 3-month follow-up, the 5-mm areas were treated at 4 mm with laser at 0.8 CW and administering LBR 1.5 W pulsed to this area FM at the beginning of the SPT to reduce bacteria. One week later, the 5 mm were treated at

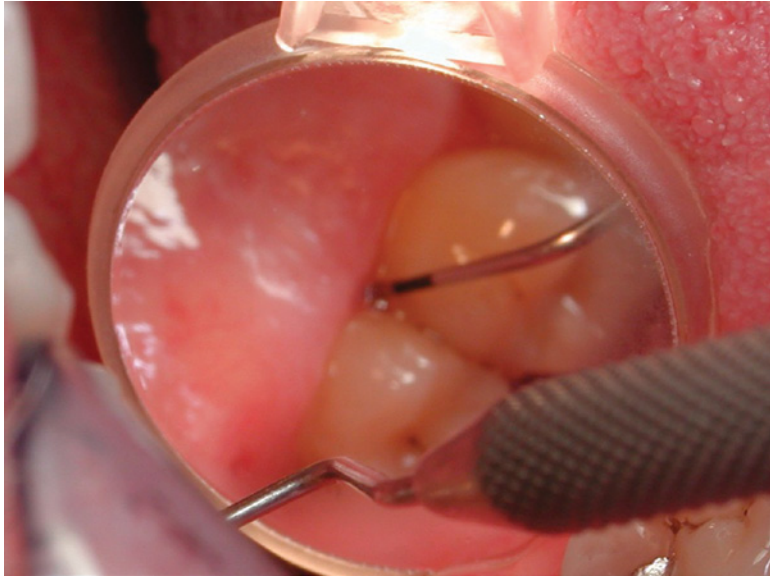


Figure 11.11 Before #2 DL: 6 mm, moderate periodontal disease.

3 mm and the 4 mm at 3 mm. Three months later, following this retreatment and 6 months' postoperative SPT all 4-mm pockets were treated at 3 mm (Figure 11.15). The LBR was set 1.5 W pulsed FM. He was placed on a 3-month recare program. Results were impressive.

The prognosis of this patient is fair-to-good as long as the patient conforms to good oral hygiene. Professional hygiene service and SPT was recommended every 3 months to manage and maintain his periodontal condition at a higher standard.

Short-term goals

- Initiate good plaque control with an oral hygiene program tailored to the patient's needs.
- Get a paraffin wax machine to relax his hands to get better dexterity when doing home care.
- Motivate patient to see the whole picture involved with his mouth and maintain a high level of oral hygiene.

Long-term goals

- Patient returns to health and controls inflammation to stay at health.
- Improve periodontal condition with a gain in clinical attachment levels.
- Help patient maintain a high level of oral hygiene.
- Keep the patient motivated and goal oriented with other health factors involved.

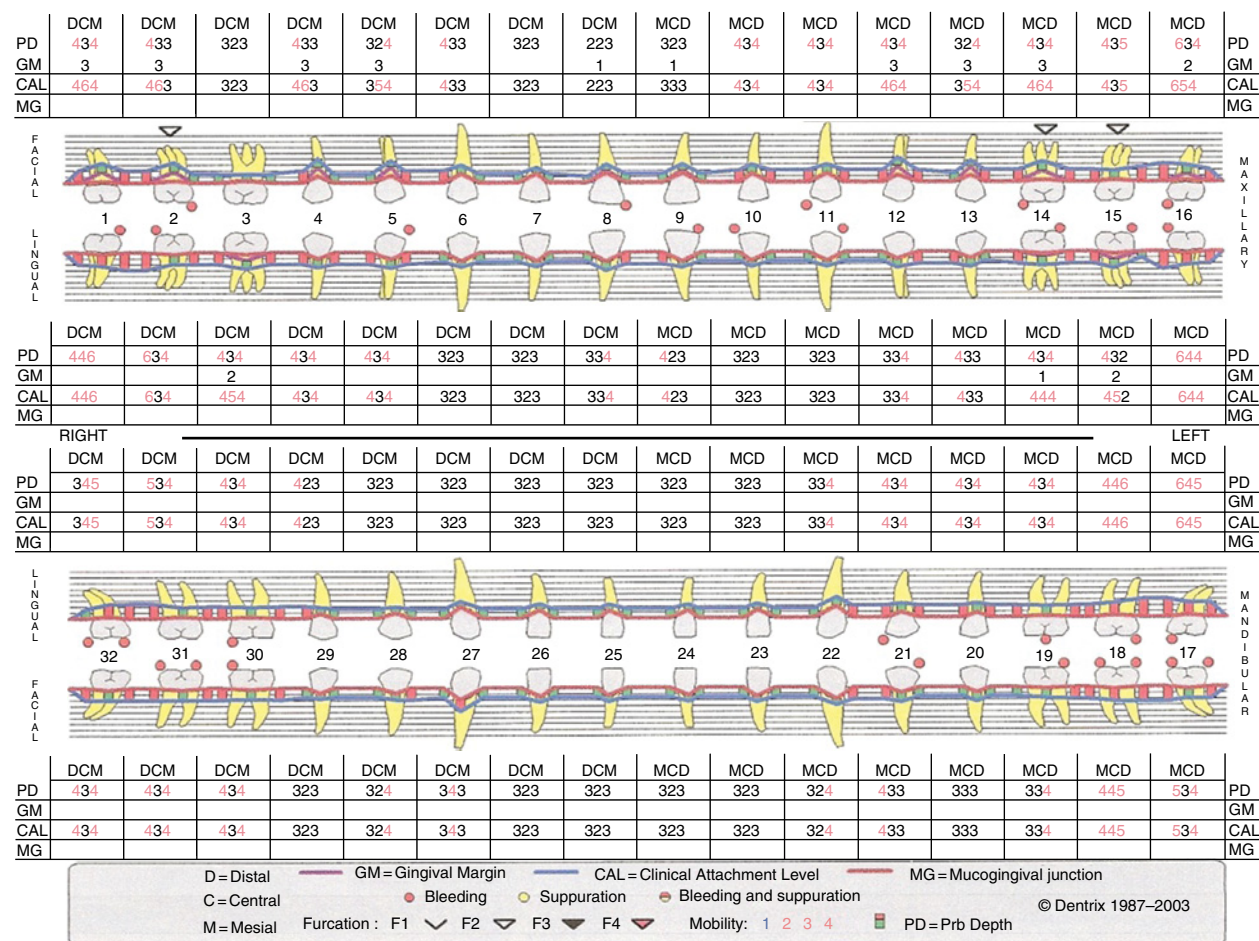


Figure 11.12 Three-month SPT: BOP=2, 4 mm=9, 5 mm=3.



Figure 11.13 After #2 DL: 3 mm.

Clinical notes

- First appointment: LBR 1.5W pulsed FM; LL quadrant molars/premolars curettage 0.8 CW; LBR 6mm at 5mm; eyewear worn; and vitamin E placed.
- Second appointment: LBR 1.5W pulsed FM; UL molars/premolars curettage 0.8 CW; LBR 1.5W pulsed 6mm at 5mm and retreated LL quadrant 6mm at 4mm; eyewear worn; and vitamin E placed.
- Third appointment: LBR 1.5W pulsed FM; UR molars/premolars curettage 0.8 CW; LBR 1.5W pulsed 20/20 6mm at 5mm and retreated UL quadrant 6mm at 4mm and LL quadrants 6mm at 3mm; eyewear worn; and vitamin E present.
- Fourth appointment: LBR 1.5W pulsed FM, LR molars/premolars curettage 0.8 CW; LBR 1.5W pulsed 20/20, 5mm at 4mm and retreated UR quadrant 6mm at 4mm and UL quadrant 6mm at 3mm; eyewear worn; and vitamin E placed.
- Fifth appointment: LBR 1.5W pulsed FM; upper anterior curettage 0.8 CW; LBR 1.5W pulsed 20/20 4mm at 3mm; retreated LR quadrant 5mm at 3mm and UR 6mm at 3mm; eyewear worn; and vitamin E placed.
- Sixth appointment: LBR 1.5W pulsed FM; lower anterior curettage 0.8 CW; LBR 1.5W pulsed 20/20 4mm at 3mm; eyewear worn; and vitamin E placed.

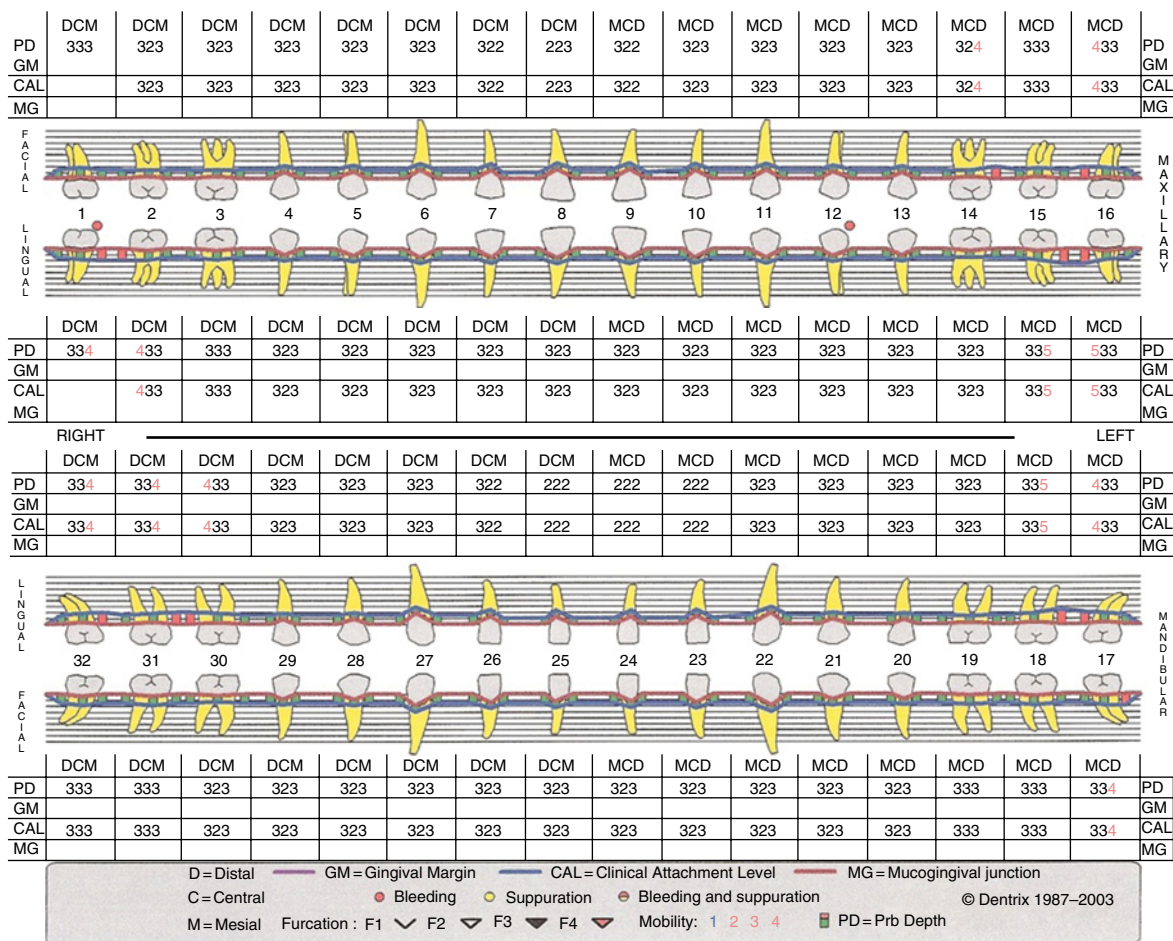


Figure 11.14 Three-month SPT: BOP = 2, 4 mm = 9, 5 mm = 3.

Case 5

MODERATE PERIODONTAL IMPLANT CASE

Darla

AGE: 80-year-old female

Health: Good

Chief complaint: Gums irritating her on UL quadrant

Clinical findings:

- Localized early with localized moderate periodontitis
- Generalized 4–6 mm present
- Moderate bleeding present/furcation involvement
- Generalized acute marginal edema
- Generalized supra- and subgingival moderate tartar
- Moderate plaque and food debris IP and along gingival margin both buccal and lingual
- Posterior moderate with localized advanced radiographic bone loss

Make sure with all treatment phases to include informed consent for LAPT rendered; protective eyewear is worn for both operator and patient; use of highest filtration masks (Class V or 0.1 micron); the environment is secured to limit access; laser-in-use warning sign placed; and reflective surfaced minimized.

The course of treatment will be IPT with FM debridement and LBR and a home care regimen.

Treatment

IPT with LBR

1. Prerinse.
2. LBR 1.5W pulsed, UIT, FM, 10–15 seconds per tooth, 5 minutes FM.
3. Disclose the patient.
4. Go over home care recommendations; do *not* overwhelm the patient.
5. Use USS FM debride.
6. LBR may need to be done again or for the first time because too much calculus is present.
7. FM periodontal probing.
8. Organize treatment protocol and present to patient.

Five periodontal therapy sessions

First session

1. Numb UL quadrant teeth #11–#15 canine, premolars, and molars.
2. LBR 1.5W pulsed, UIT, FM while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers.

4. LAPT-de-epithelization <1 mm pocket depth, in this case with 6 mm at 5 mm and other pockets in the area worked on <1 mm of previous pocket depth (i.e., 5 mm at 4 mm, 4 mm at 3 mm, and so on) initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in UL quadrant.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5 W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Second session

1. Numb UR quadrant #2–#6 canine, premolars, and molars and place topical anesthetic.
2. LBR 1.5 W pulsed, UIT, FM while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers; biofilm removal for UL quadrant with USS; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1 mm of pocket depth, in this case 6 mm at 5 mm and other pockets in the area worked on <1 mm of previous pocket depth (i.e., 5 mm at 4 mm, 4 mm at 3 mm, and so on) initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in UR quadrant and retreat UL quadrant with 6 mm at 4 mm and 5 mm at 3 mm, which is <1 mm from the week before.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5 W pulsed, uninitiated tip (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Third session

1. Numb LL quadrant #1–#5 premolars and molars and place topical anesthetic and UR and UL quadrants.
2. LBR 1.5 W pulsed, UIT, FM while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers; biofilm removal for UL quadrant with USS; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1 mm of pocket depth, in this case 5 mm at 4 mm and other pockets in the area worked on <1 mm of previous pocket depth (i.e., 4 mm at 3 mm, and so on) initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in LL quadrant, and retreat UR quadrant with 6 mm at 4 mm and UL quadrant with 6 mm at 3 mm.

5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5 W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Fourth session

1. Numb upper anterior teeth #7–#9 and place topical anesthetic on UR and LL quadrants.
2. LBR 1.5 W pulsed, UIT, FM while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers; biofilm removal for UL quadrant with USS; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1 mm of pocket depth, in this case 4 mm at 3 mm, initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in upper anterior and retreat LL quadrant with 5 mm at 3 mm and UR with 6 mm at 3 mm.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5 W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Fifth session

1. Numb LR quadrant and place topical for any possible retreats in other areas of the mouth still having edematous tissue.
2. LBR 1.5 W pulsed, UIT, FM while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers; biofilm removal for UL quadrant with USS; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1 mm of pocket depth, in this case 4 mm at 3 mm, initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in LR quadrant.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5 W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Six-week DT follow-up with LBR

1. Prerinse.
2. LBR: 1.5 W pulsed, UIT, FM, 10–15 seconds per tooth, 5 minutes FM.
3. Review and encourage OHI, and add any home care tools necessary
4. Gentle cleaning, removing any reintroduced plaque or calculus
5. Retreat any bleeding areas using USS, hand instruments, and the laser, calibrating the fiber to be 3 mm.
6. Set up 3-month recare, which is 6 weeks from the DT visit.

Six-week SPT with probing

1. Prerinse.
2. LBR: 1.5 W pulsed, UIT, FM, 10–15 seconds per tooth, 5 minutes FM.
3. Review and encourage OHI, and add any home care tools necessary.
4. Probe and celebrate any positive results.
5. Gentle cleaning, removing any reintroduced plaque or calculus.
6. Retreat any bleeding areas, unresolved pockets using USS, hand instruments, and the laser, calibrating the fiber to be <1 mm of the pocket depth.
7. Reimplement into laser therapy or set up 3-month recare.

Home care

Poor

OHI recommended

- Sonicare twice a day
- Flossing once a day
- Water pick once a day, the patient chose this method of IP plaque reduction because it was easier with dexterity issues
- CHX brush and dip once a day to help reduce edema present.

Maintenance

Three-month SPT with LBR and continual refining OHI and use of the laser to retreat any unresolved pockets if necessary.

Case presentation

Darla was an 80-year-old woman and had moderate periodontal disease with implants. Using the treatment protocol discussed in Chapter 8 (adding the deepest pockets in all four quadrants and dividing it by four equals five sessions). Because she did not have any other health indicators, it was left at five sessions to get all the pockets at 3 mm. The most involved area was treated first (Figures 11.16 and 11.17). Using the laser only, the 6-mm pockets

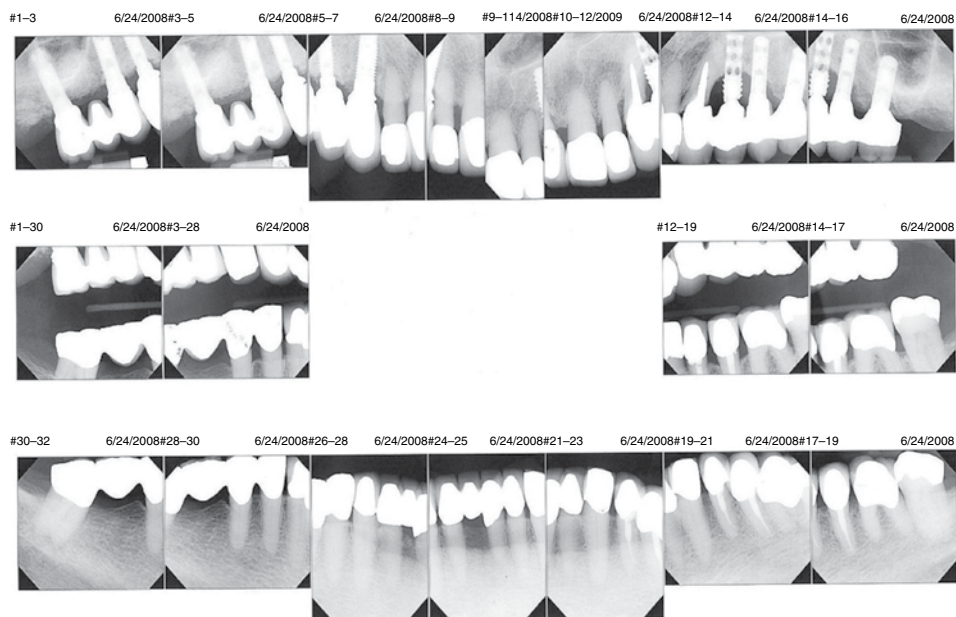


Figure 11.16 Look up at the UL quadrant in particular because of the implants.



Figure 11.17 Eighty-year old woman #10 DF: 6mm before photo.



Figure 11.18 Laser therapy: Initiated tip removal of disease tissue calibrated fiber to a 5-mm pocket, which is <1 mm initial pocket depth.

were treated at 5 mm, the 5-mm pockets at 4 mm, and the 4-mm pockets at 3 mm and the laser for LBR FM on 1.5 W pulsed for 5 minutes. Placing the laser on settings 0.8 CW for 10–15 seconds each pocket was treated (Figures 11.18, 11.19, and 11.20). The dead necrotic tissue was flushed out of the pocket with the USS and then followed by the laser for LBR at 1.5 W pulsed for 15–20 seconds per tooth (both buccal and lingual) just in these diseased areas to create biostimulation within the pocket (Figures 11.21, 11.22, and 11.23). At the treatment assessment, every 3 months and referring to the 1-year follow-up, the 5-mm pockets were treated at 4 mm with laser at 0.8 CW, and the LBR was administered at 1.5 W pulsed to this area and FM at the beginning of the SPT appointment to reduce bacteria. SPT was continued, with hygiene service, and the laser to retreat any unresolved pocketing every 3 months.

The prognosis of this patient is great as long as the patient conforms to good oral hygiene and recommended interval for professional hygiene services every 3 months to manage and maintain her periodontal condition at a higher standard.

Short-term goals

- Initiate good plaque control with an oral hygiene program tailored to the patient's needs.
- Work on goals to better home care and improve home care around the implants.

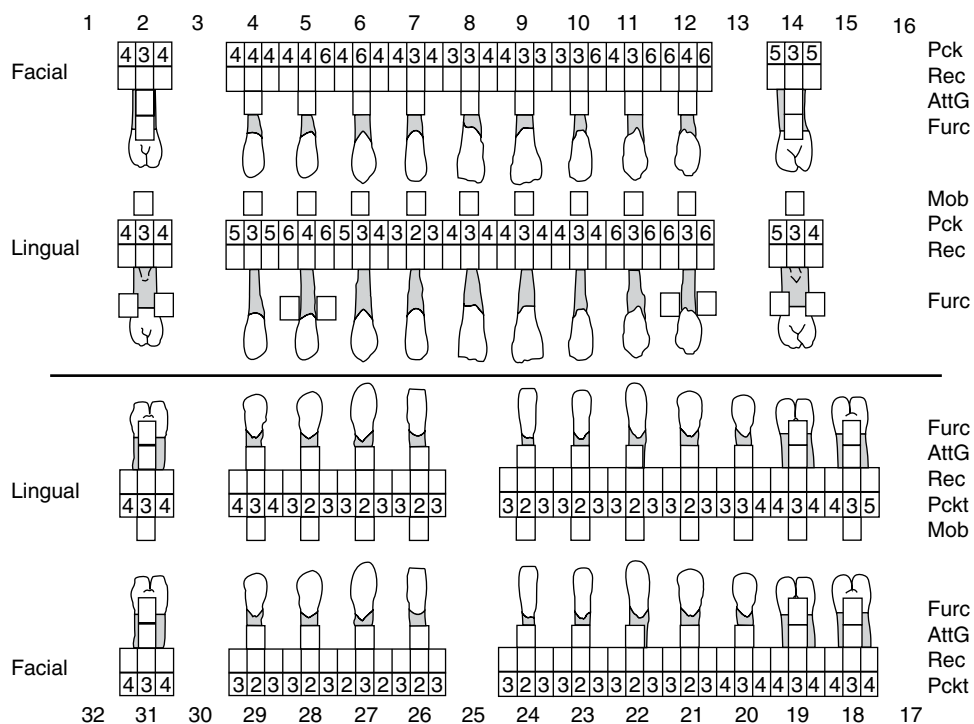


Figure 11.19 Initial probing depths assessment: BOP=generalized, 4 mm=40, 5 mm=8, 6 mm=12.



Figure 11.20 Three months after photo of #10 DL, 3 mm.



Figure 11.21 Six months after #10 DF 2mm. Note: Look at the tissue coloring compared to the first photo taken and how healthy it appears.

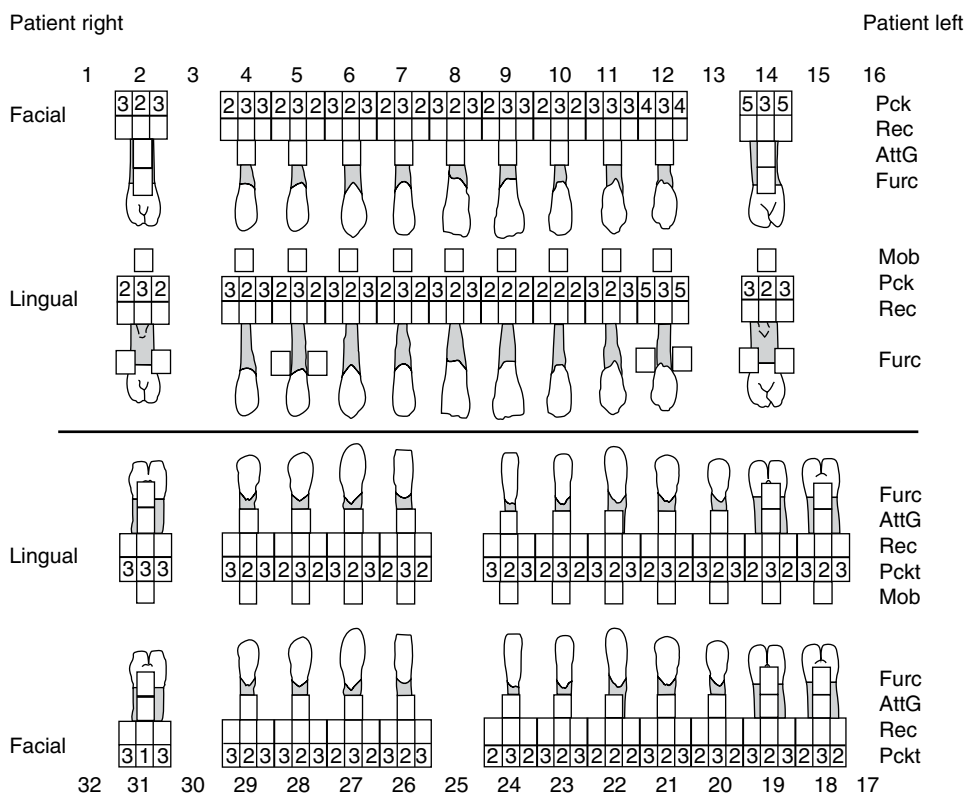


Figure 11.22 One year later probe depths: BOP=3, 4 mm=2, 5 mm=2.



Figure 11.23 One year later around UL #10–#13. Look at the new boney regeneration occurring in this photo 1 year after laser therapy around these implants.

- Motivate patient to see the whole picture involved with her mouth and maintain a high level of oral hygiene.

Long-term goals

- Patient returns to health and controls inflammation to stay at health.
- Improve periodontal condition with a gain in clinical attachment levels.
- Help patient maintain a high level of oral hygiene.

The potential for laser application in promoting long-term success via bacterial reduction exists. As always, clinicians are advised to review the specific indications for use of their lasers and to review their operator manuals for guidance on operating parameters before attempting similar techniques on their patients.

Clinical notes

- Any notes you would normally record in regard to anesthetic and periodontal procedure administered or OHI and tissue description.

- First appointment: LBR 1.5W pulsed FM; UL quadrant canine, molars/premolars curettage 0.8 CW; LBR 6mm at 5mm; eyewear worn; and vitamin E placed.
- Second appointment: LBR 1.5W pulsed FM; UR quadrant canine molars/premolars curettage 0.8 CW; LBR 1.5W pulsed 6mm at 5mm, and retreat UL quadrant with 6mm at 4mm; eyewear worn; and vitamin E placed.
- Third appointment: LBR 1.5W pulsed FM; LL quadrant molars/premolars curettage 0.8 CW; LBR 1.5W pulsed 20/20 with 5mm at 4mm and retreat UR quadrant with 6mm at 4mm and UL quadrant with 6mm at 3mm; eyewear worn; and vitamin E placed.
- Fourth appointment: LBR 1.5W pulsed FM; upper anteriors curettage 0.8 CW; LBR 1.5W pulsed 20/20 with 4mm at 3mm and retreat UR with 6mm at 3mm and LL with 5mm at 3mm; eyewear worn; and vitamin E placed.
- Fifth appointment: LBR 1.5W pulsed FM; LR curettage 0.8 CW; LBR 1.5 W pulsed 20/20 with 4mm at 3mm; and retreat, if necessary, any unresolved pockets looking edematous; eyewear worn; and vitamin E placed.

Case 6

ADVANCED PERIODONTAL DISEASE CASE

- Inflamed tissue
- BOP or suppuration on probing
- Pockets, 7 mm or greater, on posterior teeth
- Rough subgingival root surfaces
- Extensive subgingival calculus
- Mobility
- Treatment takes 6–12 hours

Connie

AGE: 59-year-old female

Health: Healthy

Smoker: 1 pack a day

Clinical findings

- Generalized advanced periodontitis with suppuration present
- Generalized 4–9 mm present
- No bleeding until starting scaling/lasing then moderate-heavy
- No stippling, shiny, bulbous unhealthy gingiva
- Generalized supra- and subgingival moderate tartar
- Moderate plaque IP and along gingival margin both buccal and lingual
- FM failing restorations/furcation involvement
- Posterior advanced radiographic bone loss

Treatment

Make sure with all treatment phases to include informed consent for LAPT rendered; protective eyewear is worn for both operator and patient; use of highest filtration masks (Class V or 0.1 micron); the environment is secured to limit access; laser-in-use warning sign placed; and reflective surfaced minimized.

The course of treatment will be IPT with FM debridement and LBR and a home care regimen.

IPT with LBR

1. Prerinse.
2. LBR 1.5W pulsed, UIT, FM, 10–15 seconds per tooth, 5 minutes FM.
3. Disclose the patient.
4. Go over home care recommendations; do *not* overwhelm the patient.
5. Use USS FM debride.
6. LBR may need to be done again or for the first time because too much calculus is present.

7. FM periodontal probing.
8. Organize treatment protocol and present to patient.

Eight periodontal therapy sessions

First session

1. Numb UL quadrant teeth #14–#15 molars.
2. LBR 1.5 W pulsed, UIT, FM while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers
4. LAPT-de-epithelization <1 mm of pocket depth, in this case 9 mm at 8 mm and other pockets in the area worked on <1 mm of previous pocket depth (i.e., 5 mm at 4 mm, 4 mm at 3 mm, and so on) initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in UL quadrant.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5 W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Second session

1. Numb LL quadrant #18–#19 molars and place topical anesthetic on UL quadrant.
2. LBR 1.5 W pulsed, UIT, FM while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers; biofilm removal for UL quadrant with USS; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1 mm of pocket depth, in this case with 6 mm at 5 mm and other pockets in the area worked on <1 mm of previous pocket depth (i.e., 5 mm at 4 mm, 4 mm at 3 mm, and so on) initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in UL quadrant with 9 mm at 7 mm, which is <1 mm from the week before.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5 W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Third session

1. Numb LR quadrant molars and place topical anesthetic on UL and LL quadrants.

2. LBR 1.5W pulsed, UIT, FM while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers; biofilm removal for UL and LL quadrants with USS; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1 mm of pocket depth, in this case 5 mm at 4 mm, and other pockets in the area worked on <1 mm of previous pocket depth (i.e., 4 mm at 3 mm and so on) initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in LR quadrant, and retreat UL quadrant with 9 mm at 6 mm and LL quadrant with 6 mm at 4 mm.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5 W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Fourth session

1. Numb UR quadrant molars and placed topical anesthetic on UR, LR, and LL quadrants.
2. LBR 1.5W pulsed, UIT, FM while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers; biofilm removal for UL, LL, and LR quadrants with USS; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1 mm of pocket depth, in this case 5 mm at 4 mm, and other pockets in the area worked on <1 mm of previous pocket depth (i.e., 4 mm at 3 mm and so on) initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in UR quadrant, and retreat UL quadrant with 9 mm at 5 mm, LL quadrant with 6 mm at 3 mm, and LR quadrant with 5 mm at 3 mm.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5 W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Fifth session

1. Numb left side premolars and place topical anesthetic on UL and UR quadrants.
2. LBR 1.5W pulsed, UIT, FM while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.

3. SRP with USS and hand scalers; biofilm removal for UL and UR quadrants; no scaling is necessary because it was done the week before.
4. LAPT-de-epithelization <1mm of pocket depth, in this case 4mm at 3mm, initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed on left side of premolars, and retreat UL quadrant with 9mm at 4mm and UR quadrant with 5mm at 3mm.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Sixth session

1. Numb right side premolars and place topical anesthetic on UL quadrant.
2. LBR 1.5W pulsed, UIT, FM while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers.
4. LAPT-de-epithelization <1mm of pocket depth, in this case 4mm at 3mm, initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed on right side premolars and retreat UL quadrant with 9mm at 3mm.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Seventh session

1. Numb upper anterior teeth and place topical for any possible retreats in other areas of the mouth still having edematous tissue.
2. LBR 1.5W pulsed, UIT, FM while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers.
4. LAPT-de-epithelization <1mm of pocket depth, in this case 4mm at 3mm, initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in upper anterior teeth.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, and any unresolved inflamed red areas with previous pocketing, 15–20 seconds per tooth.

7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Eighth session

1. Numb lower anterior teeth.
2. LBR 1.5W pulsed, UIT, FM while patient is getting numb 10–15 seconds per tooth, 5 minutes FM.
3. SRP with USS and hand scalers.
4. LAPT-de-epithelization <1 mm of pocket depth, in this case 4 mm at 3 mm, initiated tip from 0.5 to 1.0 CW, up to 15 seconds per pocket or until a fresh bleed in lower anterior teeth.
5. Lavage: removal dead necrotic tissue from coagulation of tissue or protein denaturation.
6. LBR: 1.5W pulsed, UIT (cleave from step 4 to have a bare tip), just the area worked on step 4, and any unresolved inflamed red areas with previous pocketing, 15–20 seconds per tooth.
7. Irrigate with preferred irrigant, not CHX, or skip this step (i.e., iodine full strength, tooth, gum, and tonic).
8. OHI and vitamin E placed on open wound created by SRP and laser.

Six-week DT follow-up with LBR

1. Prerinse.
2. LBR: 1.5W pulsed, UIT, FM, 10–15 seconds per tooth, 5 minutes FM.
3. Review and encourage OHI, and add any home care tools necessary.
4. Gentle cleaning, removing any reintroduced plaque or calculus.
5. Retreat any bleeding areas using USS, hand instruments, and the laser, calibrating the fiber to be 3 mm.
6. Set up 3-month recare, which is 6 weeks from this visit.

Six-week SPT with probing

This is set 3 months after treatment.

1. Prerinse.
2. LBR: 1.5W pulsed, UIT, FM, 10–15 seconds per tooth, 5 minutes FM.
3. Review and encourage OHI, and add any home care tools necessary.
4. Probe and celebrate any positive results.
5. Gentle cleaning, removing any reintroduced plaque or calculus.
6. Retreat any bleeding areas, unresolved pockets using USS, hand instruments, and the laser, calibrating the fiber to be <1 mm of the pocket depth.
7. Reimplement into laser therapy or set up 3-month recare.

Home care

Poor

OHI recommended

- Manual toothbrush twice a day
- Flossing twice a day / water pick 3 months after treatment
- Dip/brush IP gingiva with CHX gluconate 0.12% once a day
- Tool kit by OMNI once a day (control prescription, toothpaste, floss, and periomed rinse)

Maintenance

Three-month SPT with LBR with continual refining OHI.

Case presentation

Continued tobacco use can severely compromise the success of periodontal therapy (Figures 11.24 and 11.25). An excellent treatment plan executed flawlessly with the latest technology does not guarantee a good result unless the patient is ready to participate completely with the clinician. Sometimes it is the human factor of a case that is the most difficult to treat.

Connie had advanced periodontal disease. Using the treatment protocol discussed in Chapter 8 (adding the deepest pockets in all four quadrants and dividing it by four equals eight sessions). Because she has furcation involvement with mal-fitting restorations, poor home care, and smoking a pack a day, the consideration for more appointments would have been appropriate; however, it was kept at eight sessions because of her personality and acceptance for at least this many appointments. The goal



Figure 11.24 Before photo #15MB: 8 mm with furcation involvement.

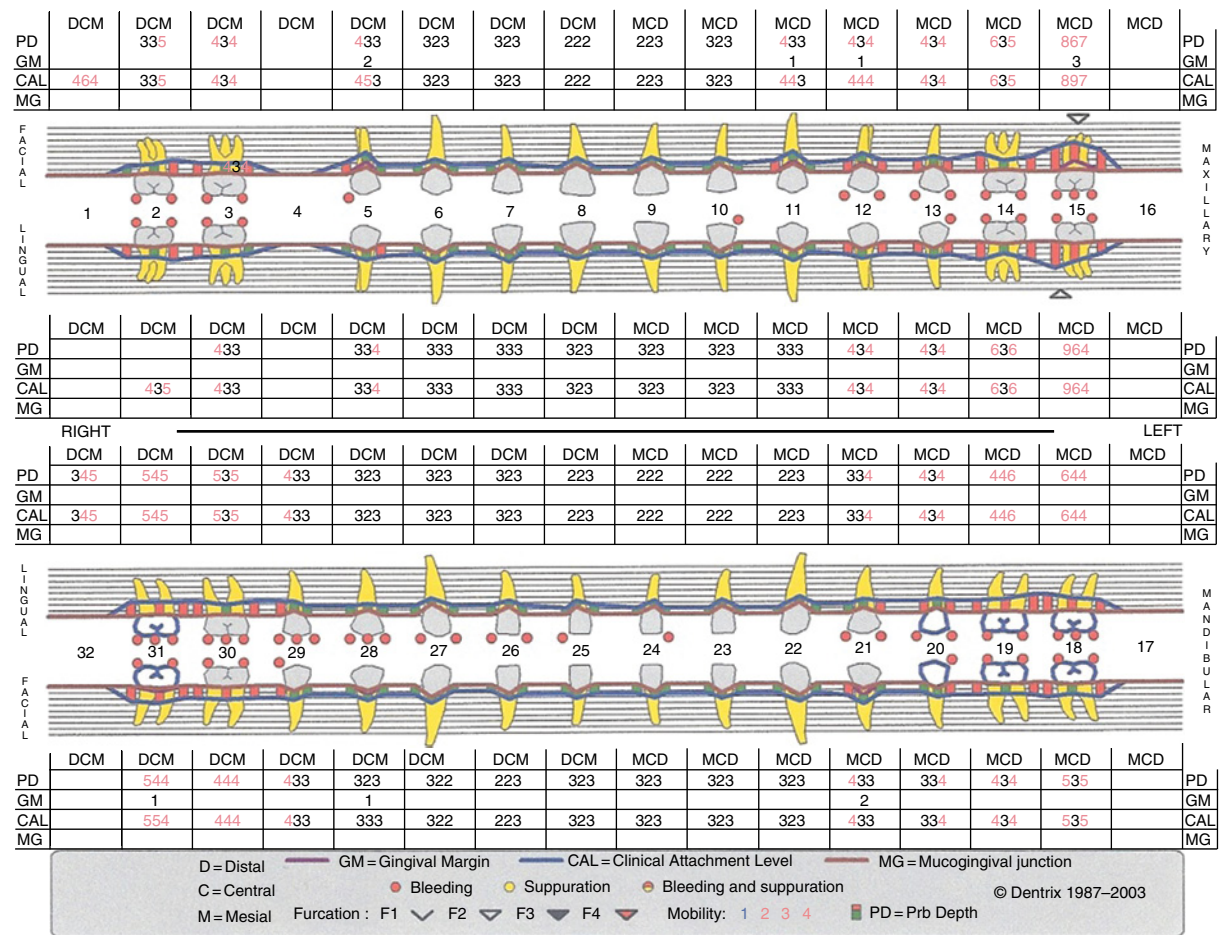


Figure 11.25 Initial probing depths assessment: BOP=61, 4 mm=34, 5 mm=10, 6 mm=7, 7 mm=1, 8 mm=1, 9 mm=1.

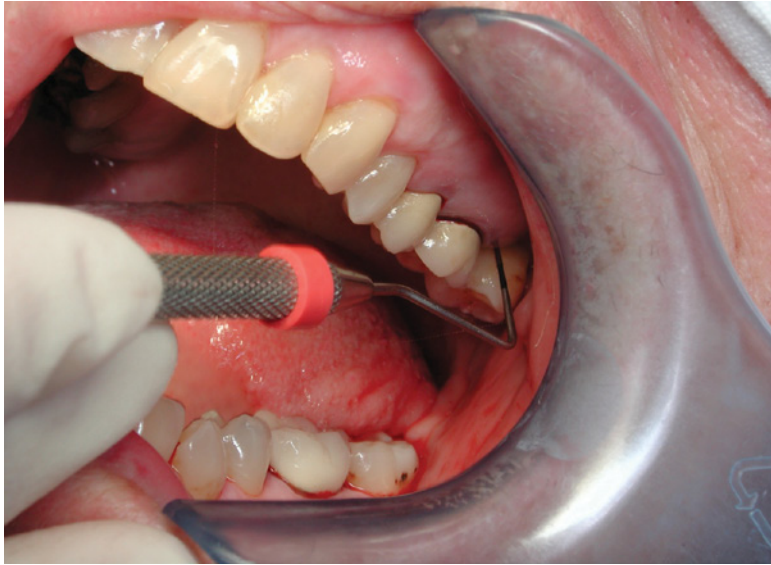


Figure 11.26 After photo #15MB: 6 mm.

was to treat all pockets at 3 mm. The most involved area was treated first. Using the laser only, the 9-mm pockets were treated at 8 mm, the 8-mm pockets at 7 mm, the 7-mm pockets at 6 mm, and so all were treated at <1 mm of initial pocket depth (Figure 11.26). The laser was used for FM LBR with the laser set on 1.5 W for 5 minutes at the beginning of the appointment and then each diseased pocket was treated placing the laser on settings 0.8 CW for 10–15 seconds for each pocket. The dead necrotic tissue was flushed out of the pocket with the USS and followed up with LBR at 1.5 W pulsed for 15–20 seconds per tooth (both buccal and lingual) in these diseased areas to create biostimulation within the pocket (Figure 11.27). At the 3-month follow-up, the 6-mm pocket was treated at 5 mm and the 4-mm pocket at 3 mm with laser at 0.8 CW and the LBR administered at 1.5 W pulsed to this area and FM at the beginning of the SPT appointment to reduce bacteria. Ideally, a treatment 1 week later to treat the 6-mm pocket at 4 mm with the same settings would have been done (but she did not return for 3 years). The treatment assessment results were impressive at the 3-month recare; however, because SPT was not continued every 3 months, restorative treatment was never rendered and smoking continued at one pack a day. When the patient returned, #15 was flapping and unfortunately had to be extracted.

The prognosis of this patient is poor because of the lifestyle factors of the patient.

Short-term goals

- Initiate good plaque control because she has poor home care with an oral hygiene program tailored to the patient's needs.

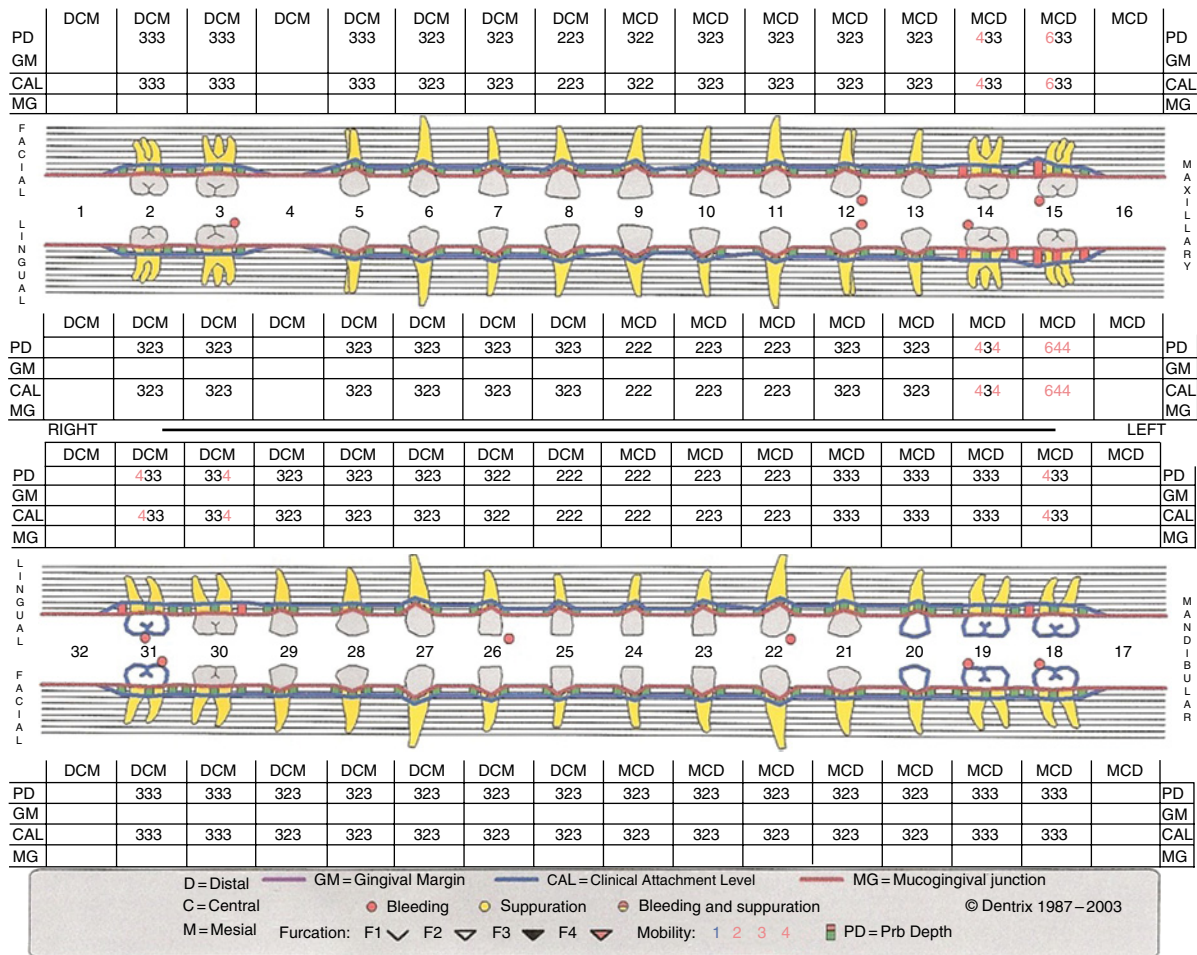


Figure 11.27 Three-month SPT: BOP = 10, 4 mm = 8, 6 mm = 2.

- Smoking cessation.
- Work on goals to better home care.
- Motivate patient to see the whole picture involved with her mouth and maintain a high level of oral hygiene.
- Encourage restorative treatment and bite adjustment to improve periodontal condition.

Long-term goals

- Patient returns to health and controls inflammation to stay at health.
- Smoking cessation.
- To get all dental treatment rendered for overall health of mouth.
- Improve periodontal condition with a gain in clinical attachment levels.
- Help patient maintain a high level of oral hygiene.

Connie did all her periodontal therapy and did not do any of her treatment recommend by the doctor.

Clinical notes

- First appointment: LBR 1.5W pulsed FM; UL molars curettage 0.8 CW; LBR 1.5W pulsed 9 mm at 8 mm; eyewear worn; and vitamin E placed.
- Second appointment: LBR 1.5W pulsed FM; LL molars curettage 0.8 CW; LBR 1.5W pulsed 6 mm at 5 mm and retreated UL with 9 mm at 7 mm; eyewear worn; and vitamin E placed.
- Third appointment: LBR 1.5W pulsed FM; LR quadrant curettage 0.8 CW; LBR 1.5W pulsed 5 mm at 4 mm and retreated LL quadrant with 6 mm at 4 mm and UL quadrant with 9 mm at 6 mm; eyewear worn; and vitamin E placed.
- Fourth appointment: LBR 1.5W pulsed FM; UR quadrant molars curettage 0.8 CW; LBR 1.5W pulsed 5 mm at 4 mm and retreated LR quadrant with 5 mm at 3 mm, LL quadrant with 6 mm at 3 mm, and UL quadrant with 9 mm at 5 mm; eyewear worn; and vitamin E placed.
- Fifth appointment: LBR 1.5W pulsed FM; left side premolars curettage 0.8 CW; LBR 1.5W pulsed 4 mm at 3 mm and retreated UR quadrant with 5 mm at 3 mm and UL quadrant with 9 mm at 4 mm; eyewear worn; and vitamin E placed.
- Sixth appointment: LBR 1.5W pulsed FM; right side premolars curettage 0.8 CW; LBR 1.5W pulsed 4 mm at 3 mm; retreated UL quadrant with 9 mm at 3 mm; eyewear worn; and vitamin E placed.
- Seventh appointment: LBR 1.5W pulsed FM; upper anteriors curettage 0.8 CW; LBR 1.5W pulsed 4 mm at 3 mm; eyewear worn; and vitamin E placed.
- Eighth appointment: LBR 1.5W pulsed FM; lower anteriors curettage 0.8 CW; LBR 1.5W pulsed 4 mm at 3 mm; eyewear worn; and vitamin E placed.

Alternate cases

Case 1

These cases can be used in the dental setting to encourage team building throughout the hygiene department. They are to be used to incorporate in hygiene meetings to practice and present to each other with the treatment planning modules discussed in previous chapters and this chapter to help develop more confidence in the laser and how to plan different periodontal cases. Every patient is different, and it is important to remember to individualize treatment for each patient.

Kirk

AGE: 62-year-old male

Health: Drug/alcohol abuse, no medications

Chief complaint: xerostomia

Clinical findings:

- Localized 4–5 mm
- Classification: _____
- Circle: Light Moderate Heavy BOP
- Localized supra- and subgingival moderate tartar in UL and UR quadrants
- Moderate plaque IP and along gingival margin both buccal and lingual
- Class 2 embrasure spaces and failing restorations
- Circle: Early Moderate Advanced radiographic bone loss

Treatment

- IPT with FM debridement and LBR and a home care regimen
- _____ periodontal therapy sessions
- Six-week DT follow-up with LBR
- Six-week SPT with probing

Home care

Poor Good Excellent

OHI recommended

- _____
- _____
- _____
- _____

Recare interval

Case presentation

Kirk questions everything. He does not like electric toothbrushes and would prefer the traditional manual toothbrush. He is insurance oriented and will only come twice a year after treatment is performed. Dental goals: To get his gums healthy and to stay healthy (Figures 11.28–11.30, and 11.31).

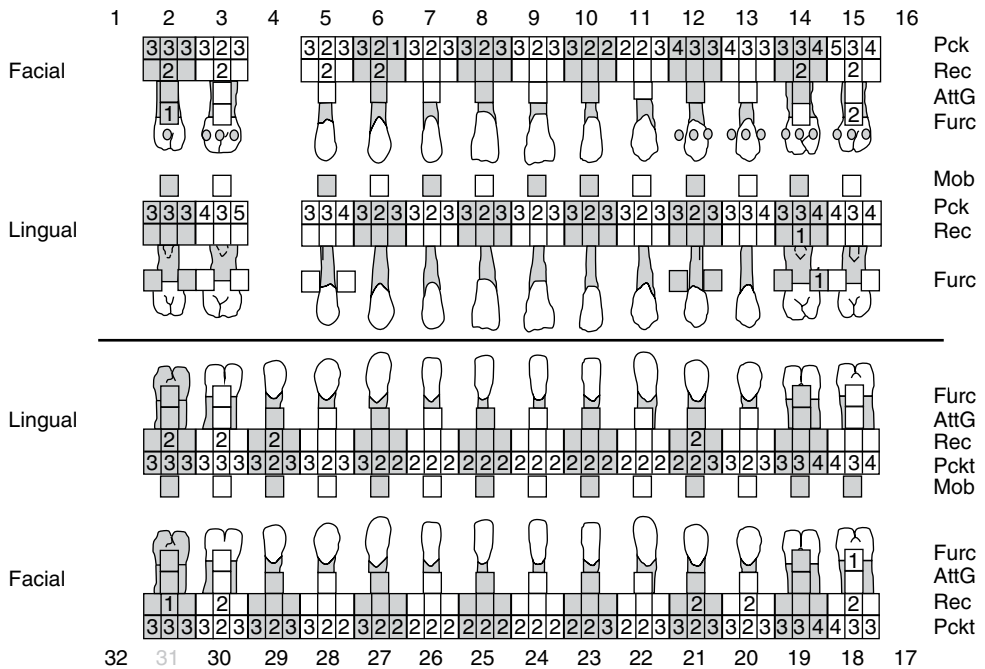


Figure 11.28 BOP=16, 4mm=16, 5mm=2.

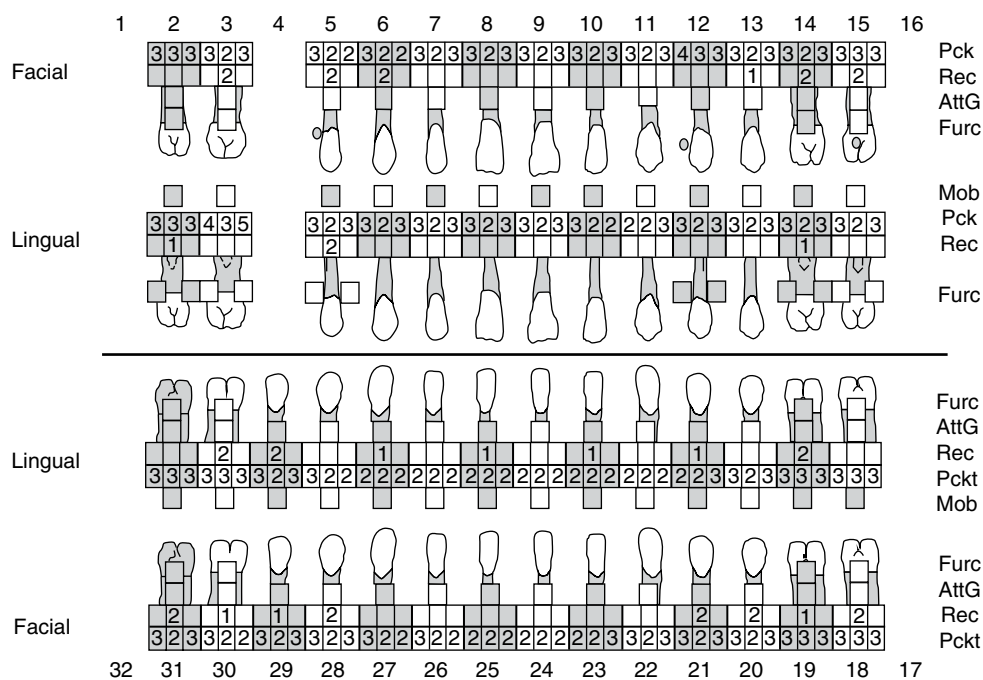


Figure 11.29 Three-month SPT: BOP=3, 4 mm=2.

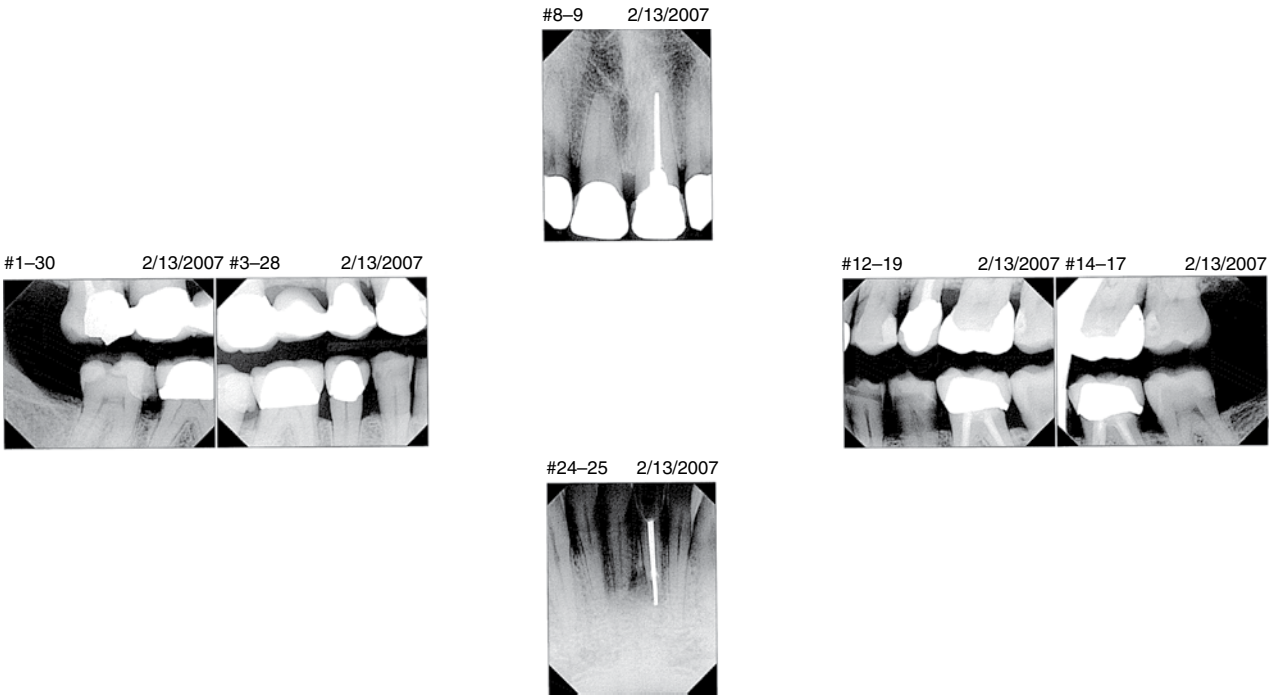


Figure 11.30 Bitewings after laser treatment.

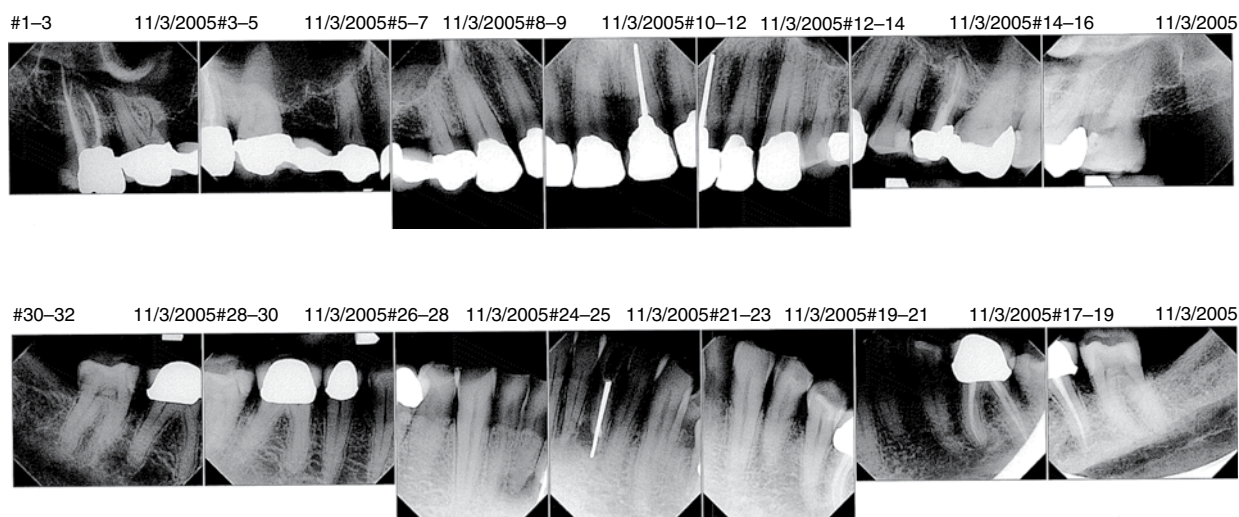


Figure 11.31 FM series before laser treatment.

Case 2

Derek

AGE: 39-year-old male

Health: Healthy, no medications

Clinical findings:

- Localized 4–5 mm
- Classification: _____
- Light Moderate Heavy BOP
- Generalized supra- and subgingival light tartar (veneer like)
- Moderate plaque IP and along gingival margin both buccal and lingual
- Posterior slight radiographic bone loss

Treatment

- IPT with FM debridement and LBR and a home care regimen.
- _____ periodontal therapy sessions
- Six-week DT follow-up with LBR
- Six-week SPT with probing

Home care

Poor Fair Good Excellent

OHI recommended

- _____
- _____
- _____
- _____

Recare interval

Case presentation

Derek hates electric toothbrushes, but he has never tried one. He will absolutely not floss. He is open to treatment and accepting (Figures 11.32 and 11.33). Dental goals: To get his mouth as healthy as possible.

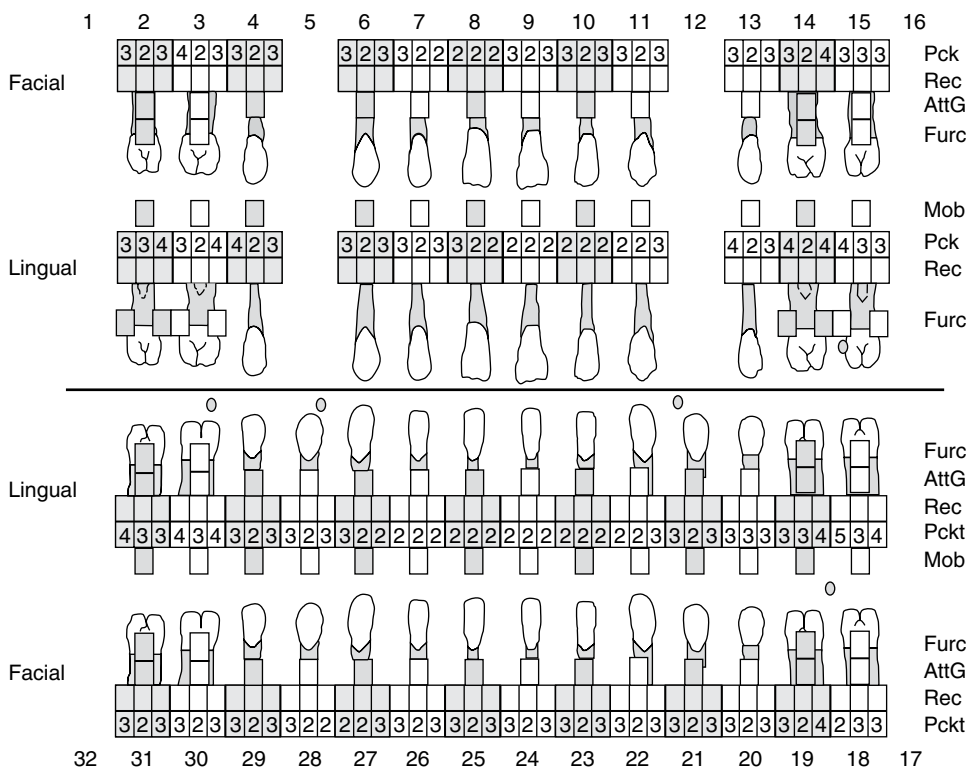


Figure 11.32 BOP=5, 4mm=16, 5mm=1.

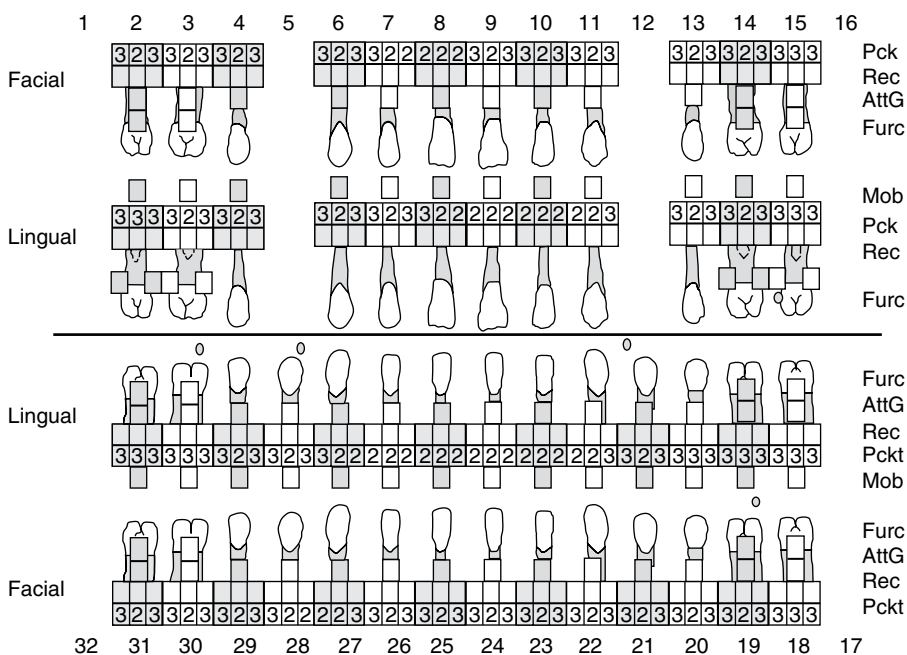


Figure 11.33 Three-month SPT: BOP=5, 4mm=0, 5mm=0.

Case 3

John

AGE: 29-year-old male
Health: Healthy, no medications
Chief complaint: bad breath

Clinical findings:

- Generalized 4–5 mm
- Classification: _____
- Generalized moderate BOP
- Generalized supra- and subgingival light tartar, moderate on lower anteriors and UR and UL quadrant buccal molars
- Moderate plaque under contacts and along gingival margin on the lingual of the mandibular arch.
- Circle: Early Moderate Advanced radiographic bone loss

Treatment

- IPT with FM debridement and LBR and a home care regimen
- _____ periodontal therapy sessions
- Six-week DT follow-up with LBR
- Six-week SPT with probing

Home care

Poor Fair Good Excellent

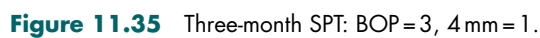
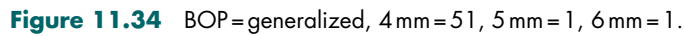
OHI recommended

- _____
- _____
- _____
- _____

Recare interval

Case presentation

John is all about whatever treatment is needed to get this done. He is global and does not like details just the bottom line (Figures 11.34, 11.35, and 11.36). Dental goals: Teeth whitened and get his bad breath cleared up.



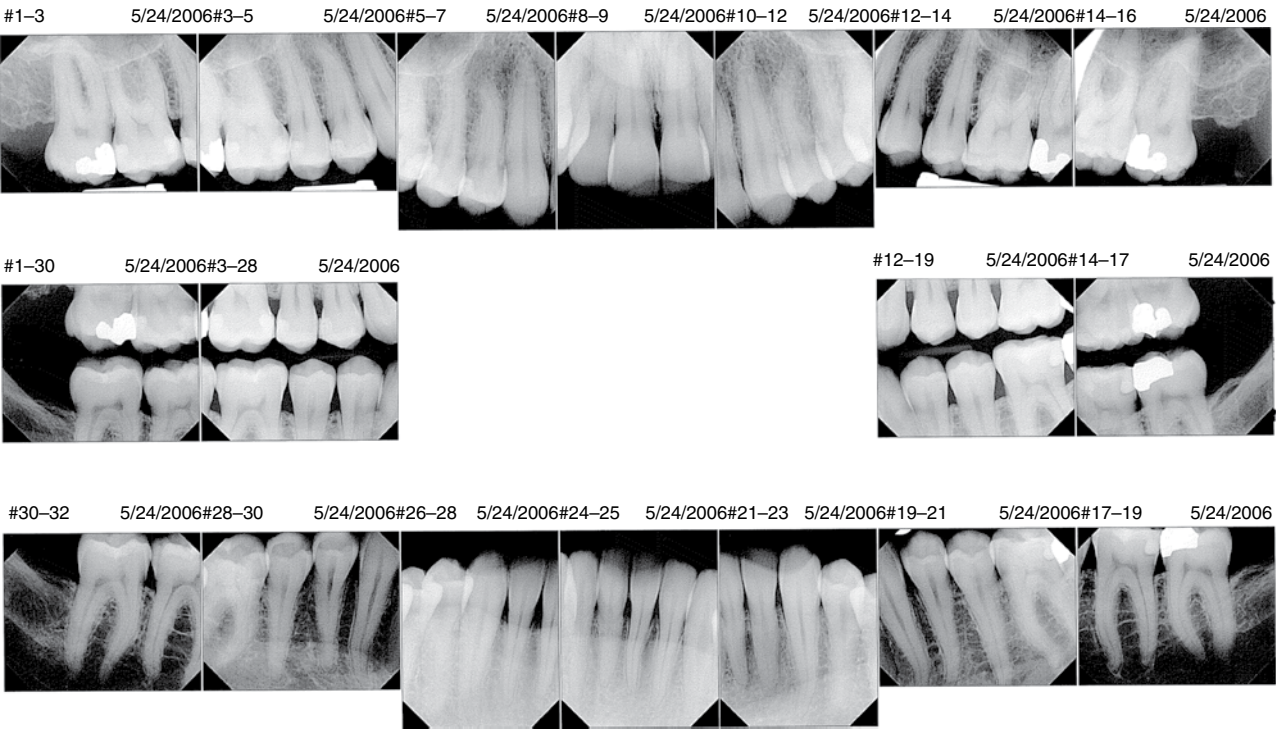


Figure 11.36 FM series before laser treatment.

Case 4

Paula

AGE: 48-year-old-female

Health: Healthy, no medications

Chief complaint: UL tooth is sensitive along the gum line.

Clinical findings:

- Generalized 4–6 mm
- Classification: _____
- Generalized moderate BOP
- Generalized supra- and subgingival moderate tartar
- Generalized recession
- Moderate plaque under contacts and along gingival margin
- Circle: Early Moderate Advanced radiographic bone loss

Treatment

- IPT with FM debridement and LBR and a home care regimen
- _____ periodontal therapy sessions
- Six-week DT follow-up with LBR
- Six-week SPT with probing

Home care

Poor Fair Good Excellent

OHI recommended

- _____
- _____
- _____
- _____

Recare interval

Paula is money conscious and anxious. She wants to try to cut down treatment to the minimum without compromising her teeth. She needs a new oven and this is priority over her teeth. She is detailed and sensitive. She starts to cry when told she has gum disease (Figures 11.37, 11.38, and 11.39). Dental goals: To never have to come to the dentist again.

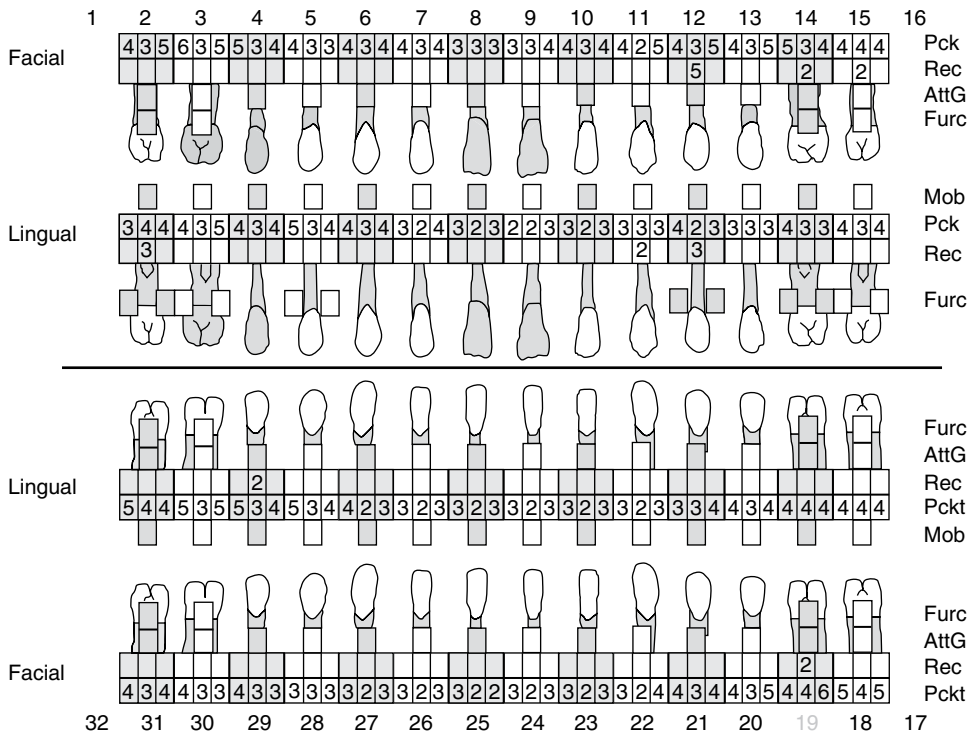


Figure 11.37 BOP=generalized, 4 mm = 55, 5 mm = 16, 6 mm = 2.

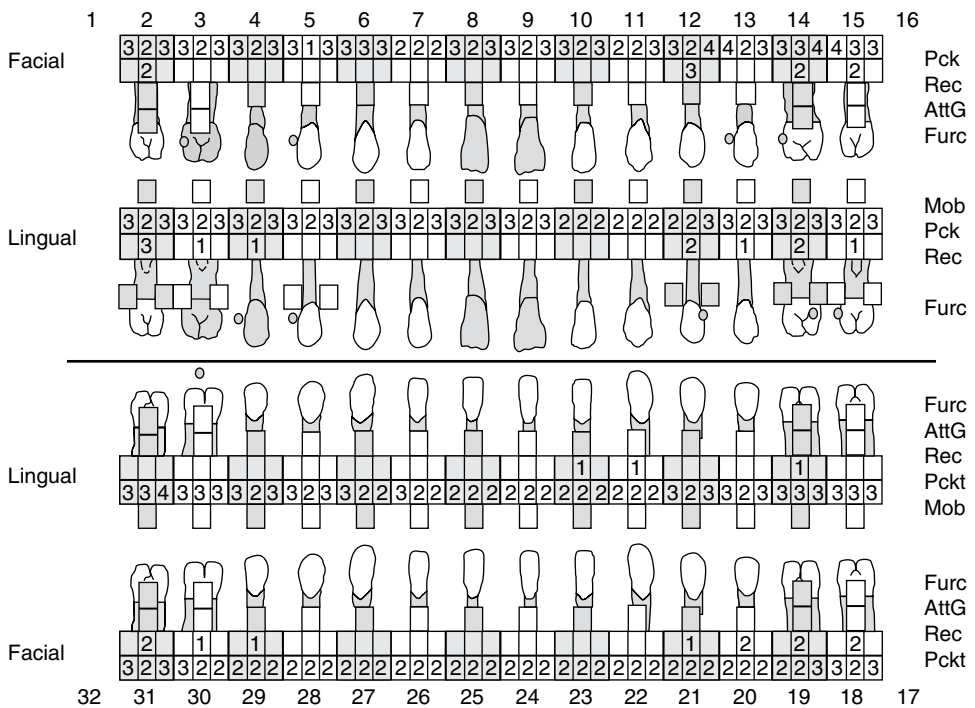


Figure 11.38 Three-month SPT: BOP = 10, 4 mm = 5.

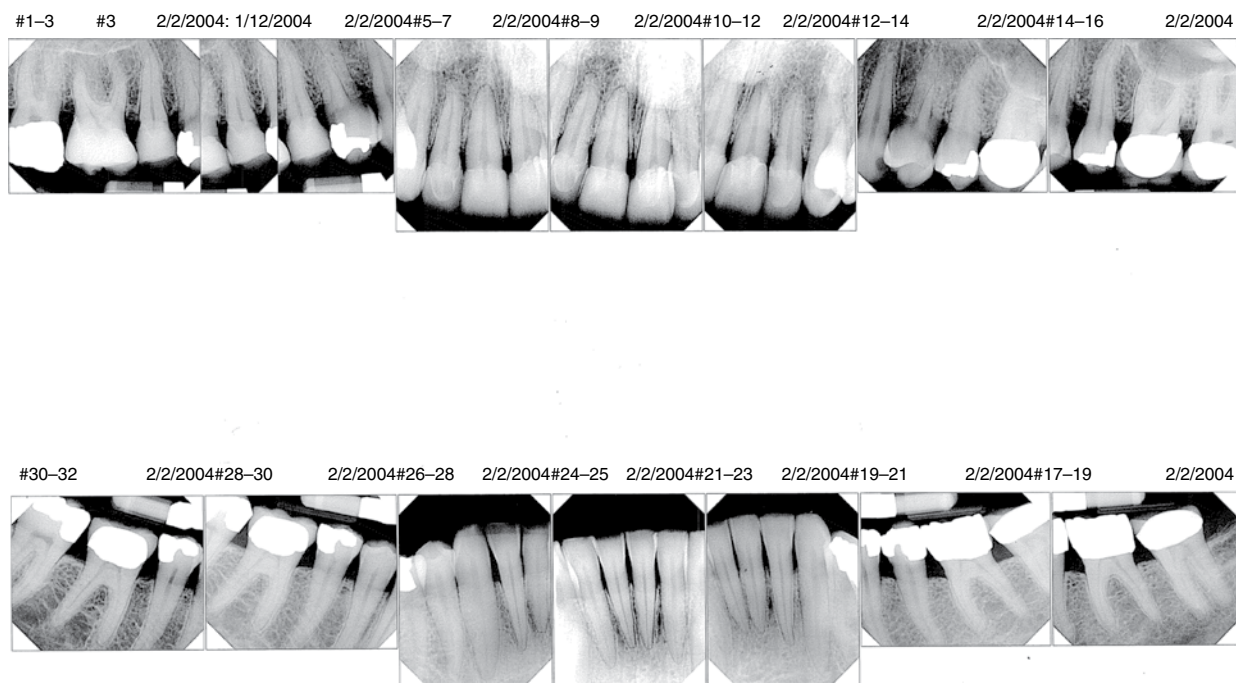


Figure 11.39 FM series before laser treatment.

Case 5

Nina

AGE: 47-year-old female

Health: Healthy, no medications

Chief complaint: Flipper is causing malocclusion and needs to be adjusted

Clinical findings:

- Generalized 4–8 mm
- Classification: _____
- Generalized heavy BOP
- Generalized supra- and subgingival Early Moderate Heavy tartar
- Generalized recession and furcation involvement
- Generalized moderate plaque
- Circle: Early Moderate Advanced radiographic bone loss

Treatment

- IPT with FM debridement and LBR and a home care regimen
- _____ periodontal therapy sessions
- Six-week DT follow-up with LBR
- Six-week SPT with probing

Home care

Poor Fair Good Excellent

OHI recommended

- _____
- _____
- _____
- _____

Recare interval

Case presentation

Nina is compliant. She will do all treatment that is necessary to do (Figures 11.40, 11.41, and 11.42). She loves her cats. She has to get her dental work done to attend nursing school. Dental goals: To have a healthy smile.

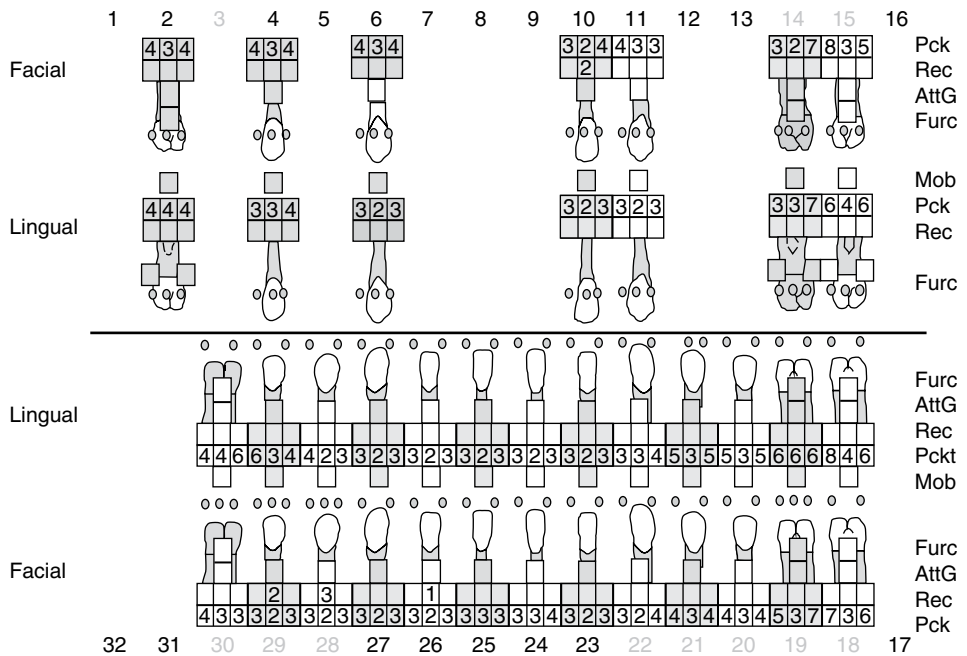


Figure 11.40 BOP=generalized, 4 mm=25, 5 mm=5, 6 mm=9, 7 mm=4, 8 mm=2.

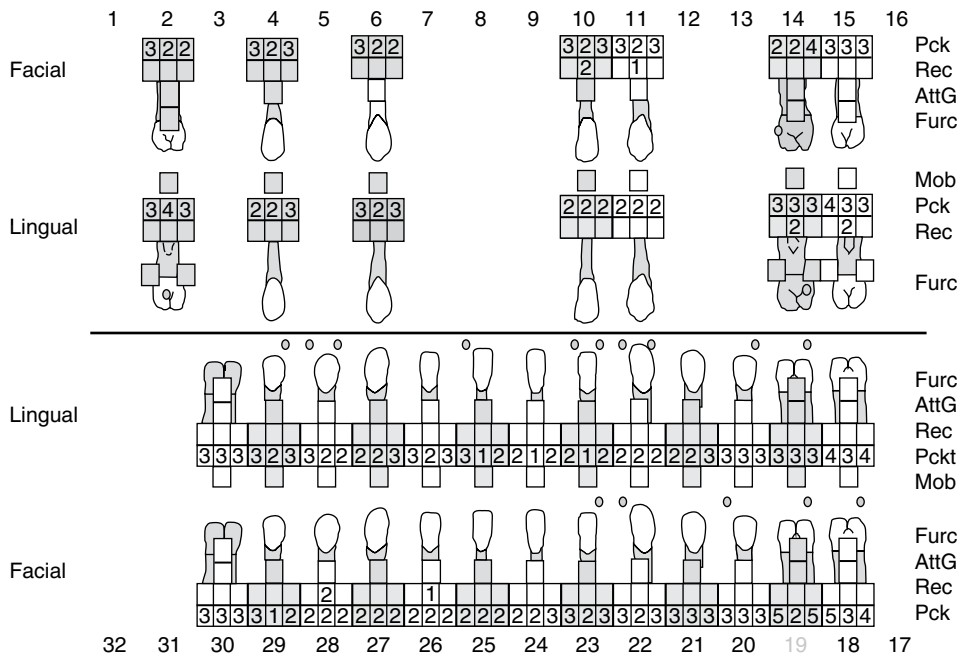


Figure 11.41 Three-month SPT: BOP = 17, 4 mm 6, 5 mm = 2.

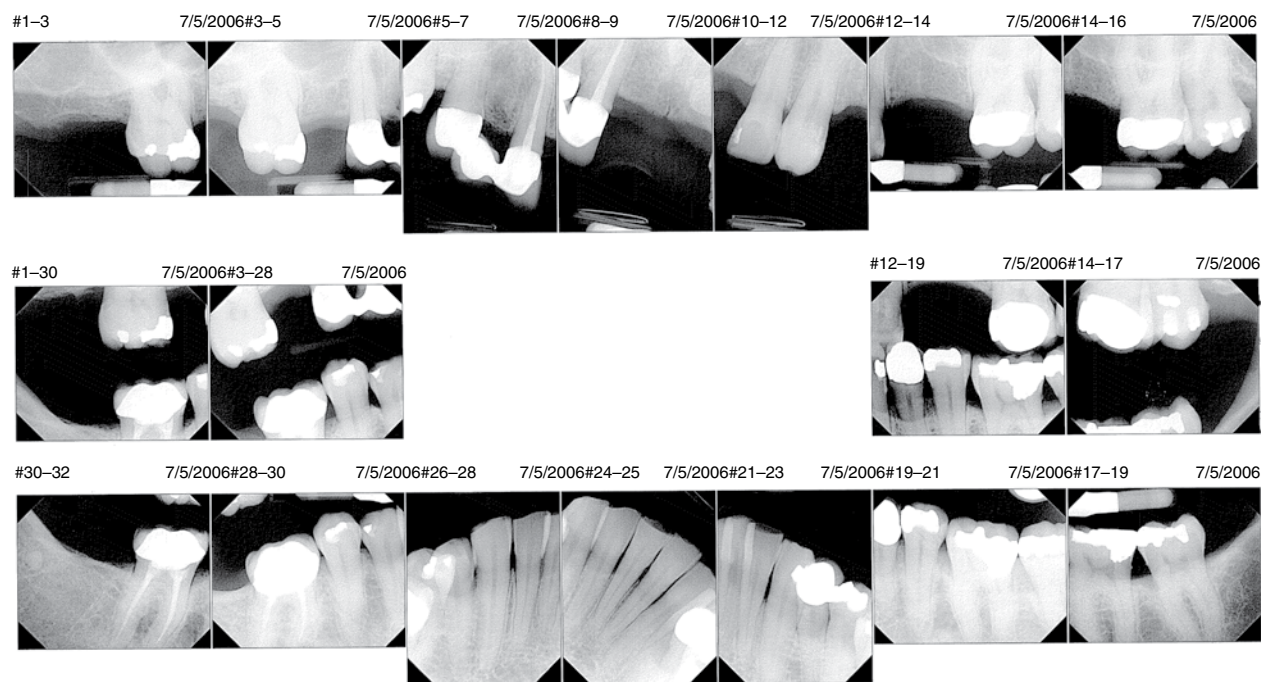


Figure 11.42 FM series before laser treatment.

Case 6

Lori

AGE: 43-year-old female

Health: Taking high blood pressure and cholesterol medications

Chief complaint: Aphthous ulcers generalized because she is under stress at work

Clinical findings:

- Generalized 4–11 mm
- Classification: _____
- Generalized heavy BOP
- Generalized supra- and subgingival heavy tartar
- Generalized recession/furcation involvement/suppuratation
- Class 2 mobility present on maxillary anteriors
- Generalized light plaque
- Circle: Early Moderate Advanced radiographic bone loss

Treatment

- IPT with FM debridement and LBR and a home care regimen
- _____ periodontal therapy sessions
- Six-week DT follow-up with LBR
- Six-week SPT with probing

Home care

Poor Fair Good Excellent

OHI recommended

- _____
- _____
- _____
- _____

Recare interval

Case presentation

Lori has a language barrier. She arrives at your dental office always on the phone so you always get started 20 minutes late. She has had periodontal surgery once before and was about to go forward again until she found the laser (Figures 11.43–11.46, and 11.47). Dental goals: To never have to undergo periodontal surgery again.

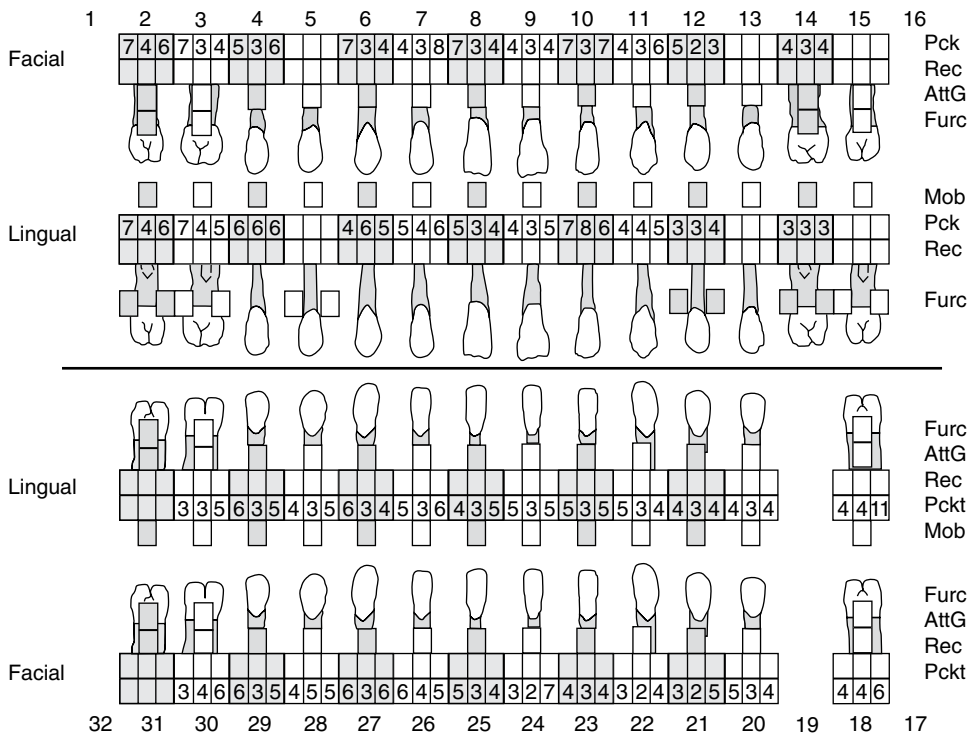


Figure 11.43 BOP=generalized, 4 mm=41, 5 mm=21, 6 mm =19, 7 mm=10, 8 mm=2, 11 mm=1.

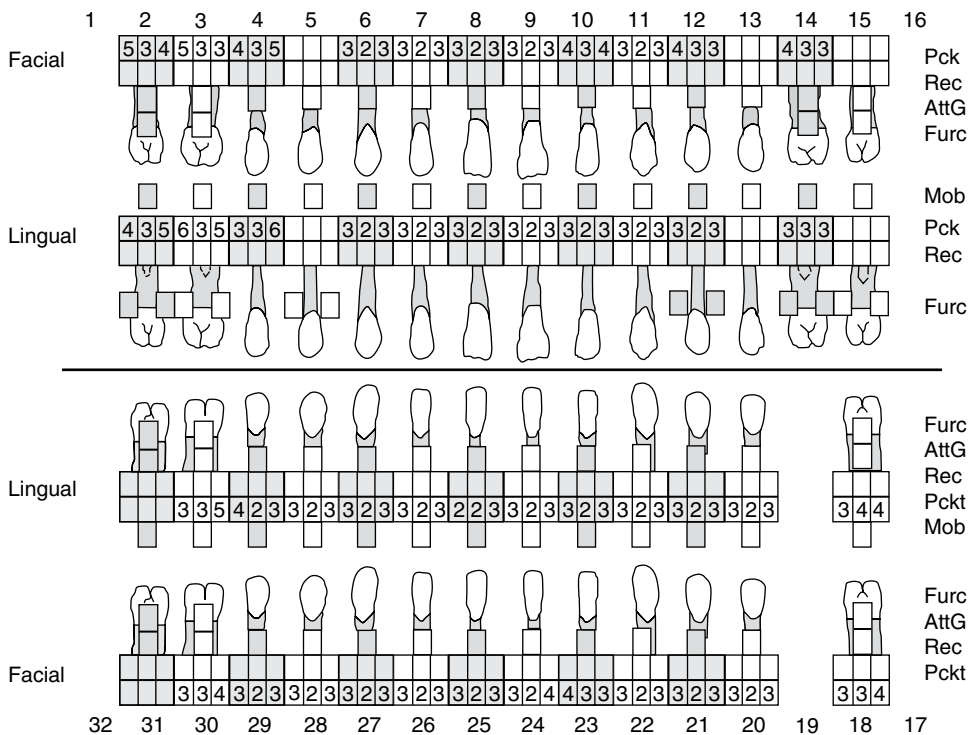


Figure 11.44 Three-month SPT: BOP=14, 4 mm=14, 5 mm=5, 6 mm=2.

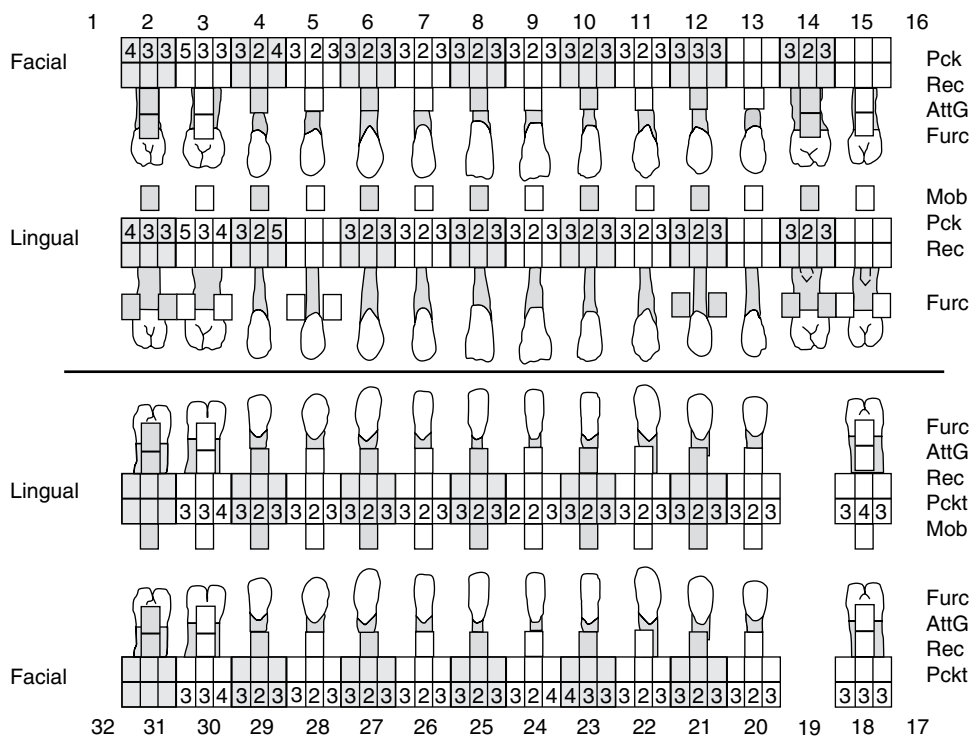


Figure 11.45 Six-month SPT: BOP = 11, 4 mm = 6, 5 mm = 3.

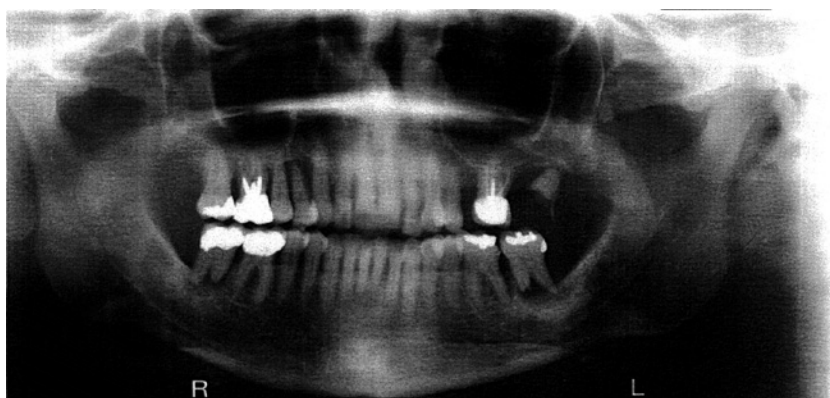


Figure 11.46 Pano before laser treatment.

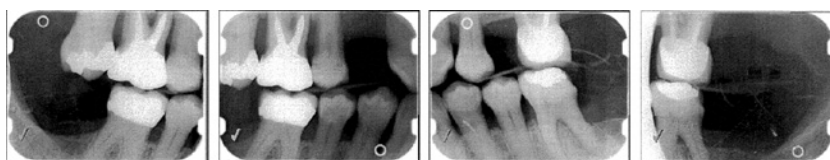


Figure 11.47 Bitewings before laser treatment.

SUPPLEMENTAL CASES AND RESULTS

Clark had localized advanced periodontal disease and using the steps to the classic appointment in Chapter 8, his pocket depth #14 MB 9-mm pocket came down to a 2-mm pocket (Figures 11.48–11.74).



Figure 11.48 #14 8 mm: Significant vertical bone loss.



Figure 11.49 #14 4 mm: Bone regeneration and bone feathering indicating bone growth.



Figure 11.50 #14MB 9mm: With bone loss.



Figure 11.51 #14MB 3mm: 1 year later.



Figure 11.52 #14MB 3 mm: After photo.



Figure 11.53 Failing implant #28 with suppuration, inflammation, and bleeding present (distal 6-mm pocket).



Figure 11.54 Initial bone regeneration of implant #28 D 3 mm 6 months later.



Figure 11.55 #18 Mandibular left second molar mesial facial 4 mm.



Figure 11.56 Laser fiber in pocket.



Figure 11.57 Immediate postoperative looking for "fresh bleed."



Figure 11.58 Six months postoperative.



Figure 11.59 #5 Maxillary right first premolar MB 7 mm.



Figure 11.60 Laser in pocket.



Figure 11.61 Postoperative laser treatment.

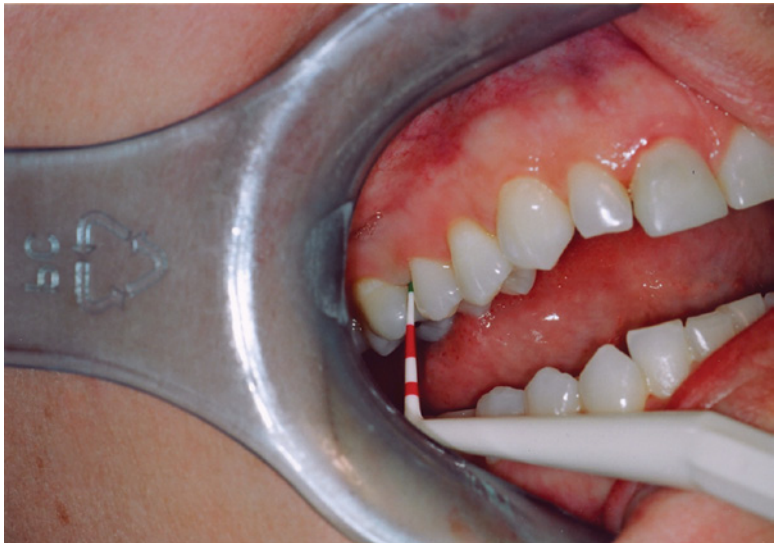


Figure 11.62 At 6 months 3 mm.



Figure 11.63 #31 Mandibular right second molar mesial lingual 5 mm.



Figure 11.64 Laser in pocket.



Figure 11.65 Postoperative fresh bleed.



Figure 11.66 At 6 months 4 mm.



Figure 11.67 #18 Mandibular left first molar mesial facial 5 mm.



Figure 11.68 Laser in pocket.



Figure 11.69 Fresh postoperative bleed.



Figure 11.70 At 6 months 3 mm.



Figure 11.71 #15 Maxillary left first molar mesial facial 5 mm.



Figure 11.72 Laser in pocket.



Figure 11.73 Fresh postoperative bleed.



Figure 11.74 At 6 months 3 mm.

Herpetic lesion 1

Refer to Figures 11.75–11.78 for herpetic lesion.



Figure 11.75 Day 1.



Figure 11.76 Day 2.



Figure 11.77 Day 7.



Figure 11.78 Postoperation.

Herpetic lesion 2: cosmetic tattooing

Refer to Figures 11.79–11.82 for cosmetic tattooing.



Figure 11.79 Day 1.



Figure 11.80 Day 2.



Figure 11.81 Day 7.



Figure 11.82 3 Weeks later.

REFERENCE

Kim, J., and S. Amar. 2006. Periodontal disease and systemic conditions: a bidirectional relationship. *Odontology* 94(1): 10–21.

Appendix: further educational options for laser dental hygienists

After hygienists see what a laser can do for their patients, they want to know what the next step is because they want to know what *else* lasers can do.

Before purchasing a laser, research all of the lasers available in the dental market for the hygienist's use. Employ the Internet and references from Chapter 4 to see what functions each laser has and what they can do for patients.

Some things to keep in mind are: What is the size of the laser? Is it easy to move from operatory to operatory if necessary? What type of laser do I need for my practice? How much of an investment will it be? What is the return on investment once a laser is purchased? If possible, contact a dental sales representative to see if a few demo units are available to try out. Use the laser for a couple weeks to see if that particular laser is the right fit for you and your dental practice.

After purchasing a laser, take the manufacturers' training—online, DVD, or an in-person course.

After this, you may still want additional training and education. Some of these organizations offer standard proficiency courses and then move on to trainer status (Figures A1.1–A1.3).

A few options for training include:

- Perio Laser Institute, www.periolaserinstitute.com
- The Academy of Laser Dentistry, www.laserdentistry.org



Academy of Laser Dentistry
Clinical Simulation Examination Grade Sheet

Standard Proficiency Clinical Simulation Exam Checklist Clinical Proficiency Simulation Examination

Candidate Name _____ Date _____
Device _____

1. Knowledge of machine, safety

- _____ Laser safety officer responsibilities
- _____ Laser safety mechanisms
- _____ Eye protection: Personnel, patient
- _____ Traffic: Components out of mainstream, especially fiber optic cables
- _____ Mainline supplies: Electrical, Water, Air
- _____ Combustible gases/liquids cautions. General anesthesia
- _____ Environment: Proper warning signs, limited access, minimize reflective surfaces
- _____ Adverse effects reporting mechanisms

2. Infection control, general set-up/set-down, power settings

- _____ Delivery system: Type:
 - a. fiber optic b. waveguide
 - c. articulated arm d. contact tips e. other
 Assembly, set-up. Emission mode-cw, pulsed etc.
- _____ Maintenance
 - Sterilization standards and protocol
- _____ High-volume evacuation present: purpose, precautions
- _____ Infection control: Masks, gloves
 - Uncontaminated (sterile) zone
 - Contaminated (post-treatment) zone
 - Disposal of used-up supplies
- _____ Test fire laser
- _____ Setting laser parameters: Settings for TWO procedures (detailed specification)
 - a. LOW total energy/power
 - b. HIGH total energy/power

3/ Patient management

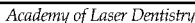
- _____ Treatment proposal: description, laser settings, informed consent
- _____ Treatment objective demonstrated
- _____ Surgical technique simulated. Tissue protection, target & non-target.
- _____ Patient management – discussion of treatment sequence, post-operative instructions
- _____ Management of complications
- _____ Surgical and healing assessment, pathology reports

_____ Pass _____ Fail

Examiner Name: _____ Signature _____

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Figure A1.1 Standard Proficiency Clinical Simulation Exam Checklist. Reprinted with permission from the Academy of Laser Dentistry.



Academy of Laser Dentistry Certification Program

**Advanced Proficiency Essential Elements of Clinical Case Studies
Examination and Checklist
Annual Conference and Exhibition Meeting**

Candidate Name: _____ Candidate No _____

Examiner Name: _____ Case No.: _____

Category of difficulty (high, med, low):

Pre- treatment (30 points)

- a) Outline of case
- _____ (7) Full clinical description: medical history, dental history, pre-treatment perio charting, occlusion, TMJ, etc.
 - _____ (2) Radiographic exam
 - _____ (2) Soft tissue status
 - _____ (2) Hard tissue status, tooth vitality
 - _____ (2) Other tests.
- b) Diagnosis
- _____ (1) Provisional diagnosis
 - _____ (1) Final diagnosis
 - _____ (3) Treatment plan outline
 - _____ (3) Indications and contraindications: treatment, laser, wavelength.
 - _____ (3) Precautions: treatment, laser, wavelength
 - _____ (2) Treatment alternatives
 - _____ (2) Informed consent

Treatment (36 points)

- _____ (6) Treatment objectives strategy
 _____ (12) Laser operating parameters
 Wavelength, delivery system, beam diameter, power, repetition
 rate, energy per pulse if appropriate, total time taken
 _____ (10) Treatment delivery sequence
 _____ (2) Post-operative instructions
 _____ (2) Complications – types, events, management
 _____ (2) Prognosis
 _____ (2) Treatment records

Follow up (12points)

- _____ (4) Assessment of treatment outcome.
Post-treatment perio charting
(specify treatment assessment intervals)
- _____ (2) Complications – types, events, management
- _____ (2) Long term results – 6months, minimum
- _____ (2) Long term prognosis

Case Documentation (22 points)

- ____ (5) Reports – treatment records, perio charts, pathology, etc.
____ (5) Radiographs – pre-op, post-op if appropriate
____ (12) Photographs, video, illustrations, etc
6 Necessary photos: pre-op, peri-op, immediate post-op, short post op interval, 3-
months post op , 6- months post-op. Photos of periodontal procedures MUST have
probe in pocket: pre-op and 6 months post op.

(Case Study Checklist reviewed June 18 2010)

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Figure A1.2 Advanced Proficiency Essential Elements of Clinical Case Studies Examination and Checklist. Reprinted with permission from the Academy of Laser Dentistry.



**Advanced Proficiency Clinical Simulation Exam Checklist
ALD Annual Conference & Exhibition**

Candidate Name _____ **Date** _____
Device _____

1. Knowledge of machine, safety (35 Points)

- _____ (10) Laser safety officer responsibilities.
- _____ (8) Laser safety mechanisms
- _____ (3) Operatory Environment
- _____ (2) Laser operational requirements
- _____ (2) Traffic
- _____ (2) Combustible gases/liquids cautions.
- _____ (5) Eye protection
- _____ (3) Adverse effects reporting mechanisms

2. Infection control, general set-up/set-down, power settings (35 Points)

- _____ (15) Delivery system
- Assembly, set-up. Emission mode, Maintenance
- _____ (2) High-volume evacuation present
- _____ (5) Infection control: Sterilization standards and protocol
- _____ (3) Test fire laser
- _____ (10) Setting laser parameters: Settings for TWO procedures
(detailed specification)
- a. LOW total energy/power
- b. HIGH total energy/power

3. Patient management (using as example the HIGH energy/power procedure in Part 2) (30 Points)

- _____ (6) Treatment proposal
- _____ (2) Treatment objective demonstrated
- _____ (14) Surgical technique simulated.
- _____ (2) Patient management
- _____ (3) Management of complications
- _____ (3) Surgical and healing assessment, pathology reports

(Case Study Presentations is omitted for LSO candidates. Marks gained in Parts Written and Clinical Exam factored to 100%)

Examiner
Name: _____ **Signature** _____

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